









# BULLETIN

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# On the forms of *Rattus rattus* occurring on the mainland of the Malay Peninsula<sup>1</sup>

By F. N. CHASEN

The Malay Peninsula is here regarded as extending from the Isthmus of Kra at Lat. 10° N. south to Singapore.

The large collection of *Rattus rattus* in the Raffles Museum has been reviewed: the chief result is the proof of the existence of a hitherto unrecognized third form of the species in the Peninsula.

For some time it has been recognized that in the island of Java and elsewhere<sup>2</sup> three distinct, stable forms of *R. rattus* are found. In Java these are the indigenous, white-bellied field rat, *R. r. roquei* Sody<sup>3</sup>; a coarser dark-bellied form, *R. r. diardi* (Jentink) found in houses and the neighbourhood of villages and usually regarded as a derivative of the first named form, now semi-parasitic on man; and thirdly, a rice-field rat, *R. r. brevicaudatus* Horst and de Raadt, not unlike *roquei* in general appearance but with a shorter tail<sup>4</sup>.

Such an association of forms has not yet been proved to exist in the Malay Peninsula but it could be expected to occur, for it can be noted that in 1918 Robinson and Kloss gave to an unique skin and skull of a rat from Korinchi, west Sumatra the name *R. r. argentiventer*<sup>5</sup>, and that ten years later Chasen and Kloss referred to this new form but without direct comparison with the type another single specimen from east Borneo<sup>6</sup>.

Furthermore, in the Raffles Museum a few Malayan specimens of *R. rattus* have been for several years segregated as probably distinct from *jalorensis* and *diardi* but the material was too poor to repay detailed study.

Now, however, I have received through the Entomologist of the Institute for Medical Research in Kuala Lumpur and the Agricultural Field Officer, Krian, Perak, good series of the doubtful form from Perak and there can be no doubt that it is distinct from both *jalorensis* and *diardi* although, until a reasonable series of *argentiventer* is available from Sumatra, it is inadvisable to separate the Perak animals from that form.

1. The forms inhabiting the islands in the Straits of Malacca were reviewed by Mr. C. Boden Kloss and myself in Bull. Raffles Mus., 5, 1931, p. 76.

2. See Dammerman, Treubia, X, 1928, p. 307.

3. *R. r. roquei* is very close to *jalorensis* but it averages slightly larger.

4. The distribution of the races of *R. rattus* in Java is discussed by F. Kopstein in detail in "Die Ökologie der javanischen Ratten" (Zeitschrift für Morphologie und Ökologie der Tiere", 22, 4, 1931, p. 774.

5. Journ. F.M.S. Mus., viii, pt. 2, 1918, p. 55.

6. Journ. Malay. Mus. Roy. Asiat. Soc., vi, 1928, p. 47.

I have to thank the Directors of the Zoological Museums at Buitenzorg, Java and at Colombo, Ceylon who kindly sent me material to study during the preparation of this paper.

1. **Rattus rattus jalorensis.** The Field-rat.

*Mus jalorensis* Bonhote, Fasciculi Malayenses, Zool., pt. i, 1903, p. 28 ("Ban Sai Kau, Nawngchik," Peninsular Siam).

*External characters.* A sleek rat. The under parts, in the great majority of specimens, white, sharply defined on the sides against the finely grizzled upper parts, but the base of the fur on the under parts sometimes grey and the general appearance below therefore cloudy.

Tail entirely black; half-way along its length the rings 9 to 11 to the centimetre.

Tail usually slightly longer than the head and body: occasionally it is a trifle shorter.

Size. No exact topotypes from Nong Chik (between Jalor and the sea, about Lat. 6° 50' N.) are available. Some adults from Ghirbi about 100 miles north of the latitude of Nong Chik average rather longer in the tail than the largest specimens from the Malay States. As the measurements of the latter agree better with the figures given by Bonhote for typical *jalorensis* the Ghirbi specimens may be regarded as showing an approach to a slightly larger northern form. In the Malay States, are found rats in which the skull attains a maximum of 17.5% above the minimum occipito-nasal length for adults. This large variation is puzzling but although I have gone to some trouble to seek confirmation of Bonhote's view that two forms of field-rat occur I cannot support his contention that a smaller form, *jalorensis* differs from a larger form "*rufescens*" in its darker, more uniform upper surface, black feet, and shorter tail and ear.

The great majority of specimens examined from the Peninsula consists of young rats. The minority, with worn teeth, can be arranged in three series according to the greatest length of the skull, series *a* less than 40 mm., *b* 40–42 mm., *c* 42–44.4 mm. Most of the local rats with worn teeth fall in series *a* and each series includes skulls in which the teeth are very worn.

It is not easy to arrange large series of skulls, comparatively, with regard to age although of course very old animals can usually be picked out<sup>1</sup>, but there is no doubt that most of the skulls in *a* are younger than those in *b* and *c*. A few, at

<sup>1</sup> None of the characters seems decisive. The teeth are well worn in some skulls showing unmistakable signs of immaturity and this character seems to depend on the local habitat and nature of the food. In one obviously very old skull the sutures anterior to the basioccipital and basisphenoid bones are not closed: the condition of the sutures is sometimes altered by careless cleaning of the skulls.

# ON THE FORMS OF RATTUS RATTUS

first sight adult, are rather too broad in the cranium: others, seen from above, have the sutures of the cranial vault too obvious, and in others the "beading" is not heavy enough to indicate old age. Eliminating skulls on all these counts only five remain in series *a* and it is doubtful whether even these few are the skulls of very old animals: nevertheless, they must be included in any series of measurements of adults. As, however, it was not found necessary to eliminate any skull from the series *b* and *c* (i.e. skulls of 40 mm. or more in occipito-nasal length) on grounds of immaturity it is reasonable to regard the five small skulls as either exceptionally small adults or, in spite of their appearance, perhaps not fully grown: I incline to the latter view.

In the following table the individual measurements<sup>1</sup> of *jalorensis* given on pages 12 and 13 are summarized. The first two columns contain the sixteen largest adults available from the Malay States and the third column the five smallest adults from the same area. The fourth column contains the measurements of four animals from Ghirbi in Peninsular Siam. The skulls of these last mentioned specimens are all large although the teeth are not very worn. This point is referred to at greater length below.

Dimension	Largest adults between Lat. 7° and 4° N.	Largest adults south of Lat. 4° N.	Smallest adults south of Lat. 7° N.	Adults from Ghirbi, about Lat. 8° N.
<i>External.</i> —				
Head and body ..	166-175 (170)	154-176 (166)	155-165 (158.5)	158-170 (164)
Tail ..	160-193 (177)	155-185 (173.9)	161-173 (165)	176-200 (192.5)
Hind-foot ..	32-35 (33)	27-33 (30.7)	29-33 (30.8)	32-35 (34)
Ear ..	20-22 (21)	17.5-22 (19.9)	16-20 (17.7)	17-22 (20.2)
Percentage of tail to head and body ..	95-115 (104)	88-112 (105)	101-106 (104)	111-122 (117)
<i>Skull.</i> —				
Occipito-nasal length	40.5-44.3 (42.1)	40-42.8 (41.2)	37.7-39.3 (38.6)	40.7-44.4 (42.2)
Condyl-basilar length	35.5-38.4	34.8-37.4	32.6-34.5	35-37.7
Greatest zygomatic breath ..	18.8-20.6	18.3-20.7	17.8-19	19.2-19.8
Post-molar length ..	17.6-18.4	17.1-18.7	15.6-17.1	17.1-18.9
Length of a nasal ..	13.7-16	13.7-15.1	12.7-13.5	14.4-16.1
Palatilar length ..	19.5-21.4	18.7-20.4	17.9-19	19.3-20.5
Diastema ..	10.9-12.3	10.7-12	10-10.8	10.6-11.5
Anterior palatal foramina ..	7.2-7.7	6.7-7.9	6.1-6.9	6.9-7.8
Upper Molar row ..	6.5-7.2	6.3-7.1	5.9-6.7	6.7-7

In all cases the external measurements were taken in the flesh but unfortunately over a period of years and by several different collectors. Hind-foot excludes claws. Upper molar row at the alveoli. Palatilar length excludes any median palatal projection. Post-molar length, condyle to m<sup>3</sup>.

The figures in brackets are the averages. The series left for study after the elimination of immature animals are, unfortunately, not very large.

Adults of *Rattus rattus jalorensis* from the Malay Peninsula, from the type locality in the north and south to Johore therefore give the following ranges in millimetres. Some averages are added in brackets.—

Head and body .. .. .	154-176 (165.6)
Tail .. .. .	155-198 (173)
Hind-foot .. .. .	27-35 (31.4)
Ear .. .. .	16-22 (19.8)
Percentage of tail to head and body .. .. .	88-115 (104.5)
Occipito-nasal length .. .. .	37.7-44.3 (40.9)
Condylar-basilar length .. .. .	32.6-38.4
Greatest zygomatic breadth .. .. .	17.8-20.7
Post-molar length .. .. .	15.6-18.7
Length of a nasal .. .. .	12.7-16
Palatilar length .. .. .	17.9-21.4
Diastema .. .. .	10-12.3
Anterior palatal foramina .. .. .	6.1-7.9
Upper molar row .. .. .	5.9-7.2

*Mammæ.* The number seems to be constant. All females examined have two pairs of pectoral and three pairs of inguinal mammæ making ten teats in all.

*Characters of the skull.* A line drawn across the anterior roots of  $M^1$  excludes the palatal foramina in the great majority of skulls and in a small minority of skulls (the proportion largest in immature animals) just includes the extreme posterior tips of the foramina for a length of less than .5 mm. In two skulls about .75 mm. is included.

*Range in the Malay Peninsula.* From central, east and north Johore and Malacca north to at least lat.  $6^{\circ} 50' N$ . It is probably the form inhabiting west and parts of south-west Johore also. Penang Island and Pulau Pangkor Besar in the Dindings.

## 2. *Rattus rattus jalorensis* > *tikos* Hinton.

*Rattus rattus tikos* Hinton, Journ. Bombay Nat. Hist. Soc., xxvi, 1919, p. 400 (Tenasserim Town).

The above is a convenient way of indicating specimens from the Malay Peninsula, north of about latitude  $8^{\circ} N$ .

In order to appreciate the exact systematic position and status of these northern rats it is necessary to glance at their relation to the field forms of *R. rattus*<sup>1</sup> found in the countries immediately north of the Malay Peninsula.

1. The validity of the various names that have been applied to these races is not a question of concern at the moment and they are here accepted as published. *R. r. thai* (1917) was directly compared with the earlier *sladeni* Anderson (1878) from the Kakhyen Hills near Bhamo and described as having larger bullæ: no colour comparison was possible as the types of *sladeni* are preserved in alcohol. *R. r. khyensis* (1919) was described without reference to either of the foregoing names and differences between it and them have yet to be demonstrated.

## ON THE FORMS OF *RATTUS RATTUS*

A convenient starting point is in Upper Burma whence, a few miles west of Kindat on the Chin Hills *R. r. khyensis* Hinton<sup>1</sup> was described. The known range of this form, as given by its describer is, approximately from Kindat, east to a point in the north Shan States between Mandalay and Lashio, and south through Mount Popa to Pegu in Lower Burma.

Next comes *R. r. thai* Kloss<sup>2</sup> described from Raheng, west Siam and as yet only known, as such, from the topotypical district.

Yet further to the south is *R. r. tikos* Hinton.<sup>3</sup> With topotypes from Tenasserim Town the author of the name associated animals from various localities to the extreme southern point of Tenasserim and Victoria Island.

Finally, from Nong Chik, just north of Jalor in the south of Peninsular Siam, came *R. r. jalorensis* Bonhote<sup>4</sup>, the presumably, indigenous field-rat of the Malay Peninsula. I have not seen *khyensis* but both *thai* and *jalorensis* seem reasonably stable forms. In the country between that occupied by these last two races in their purest form the species is highly variable and racial recognition is little more than a formality. Below, I have tried to summarize the characters of series of *R. rattus* from various localities from north to south: in some of the extra-Malayan cases I have had to rely absolutely on Mr. Hinton's published figures and descriptions.

*Colour.* *Khyensis* is described as a bright rat ("bright coloured, red-backed"). *Thai* must also be called a bright rat. Animals from Tenasserim Town south to Victoria Point are very variable: a few are as bright as some *thai*, others are as dull as any *jalorensis*. As a series *tikos* averages duller than *thai*: *jalorensis* is consistently dull in colour.

*Mammæ.*—The formula is  $3-3=12$ , or  $2-3=10$ : occasionally the pectoral mammæ are asymmetrical and then there are 11 mammæ in all. Typical *khyensis* from the Chin Hills has 12 mammæ but among 14 females of the same form from the North Shan States 1 had 11 and 2 had 10. Females from Mt. Popa, Pagan and Pegu all show 12. Of *tikos* Mr. Hinton writes "The mammæ are visible in 26 of the females; of these 8 only show the full formula of  $3-3=12$ , 9 show 11, and 9 show  $2-3=10$ ." Animals with three pairs of pectoral mammæ extend south to Bankasoon (and perhaps Victoria Point but

1. Journ. Bomb. Nat. Hist. Soc., xxvi, 1919, p. 398.

2. Journ. Nat. Hist. Soc. Siam, ii, 1917, p. 286.

3. Journ. Bomb. Nat. Hist. Soc., xxvi, 1919, p. 400.

4. Fasciculi Malayenses pt. 1, 1903, p. 28.

details are lacking) on the western side of the peninsula and to Koh Lak in south-west Siam on the other side: others with only two pairs extend north to Maprit, Tenasserim Town, and near Bangkok. There is thus a large overlap. From Ghirbi (perhaps from a point further north) southwards the formula  $2-3=10$  seems constant.

*Skull*.—The average occipito-nasal length of a series of good adults from most of the northern localities seems slightly higher than that of *Malayan jalorensis* which is 40.9 mm. Working to the north we get the following averages in millimetres for small series. Ghirbi, Peninsular Siam, 42.2; Koh Lak, south-west Siam, 43.5; south Tenasserim, 42.4; west Siam, 42.6; *khyensis* over its defined range drops to 40.6 again but only two of the skulls are said to have the teeth much worn.

*Tail*.—The following are some ranges and averages in millimetres of tail-length and average percentage of tail-length (last column) to that of the head and body. The figures for localities in Burma are taken from Hinton. In most cases the average length and the average percentage of tail-length seem to be based on a larger number of specimens than that represented by the range of the actual tail-length unless of course this latter includes the extremes of the available series.

Chin Hills	..	175-194 (182)	..	111
North Shan States		168-222 (186)	..	111
Mt. Popa	..	195-222 (198)	..	120
Pagan	..	158-196 (181)	..	120
Pegu ..	..	180-214 (197)	..	121
West Siam	..	170-210 (195)	..	108
South Tenasserim	..	161-216 (169)	..	108
Koh Lak	..	193-235 (214!)	..	118
Ghirbi ..	..	176-200 (192.5)	..	117
Malay States	..	155-193 (173)	..	104.5

To sum up, we have a rat occurring over a wide stretch of country, possibly without a serious break in distribution. Generalizing, it can be said that in the north it is bright in colour and has three pairs of pectoral mammæ: in the south it is dull in colour and has two pairs of pectoral mammæ. Furthermore, the largest skulls and longest tails are found north of the range of *jalorensis*. At irregular, and in the case of the earlier names more or less accidentally chosen points on the continuous, although not quite even line of variation, various names have been applied to the species. About these centres it is the practice of modern systematists to group their geographical races or sub-species. Unfortunately the type localities, often fixed, as

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Mr. Hugh Whistler has recently pointed out, with regard to birds, on grounds of nothing more or less than historical accident, are sometimes in intermediate areas where the species is unstable and highly variable. For practical purposes the range of *R. r. jalorensis* can for the present be considered as extending to roughly Lat. 7° N. Animals from a degree further north are not quite typical: they average rather large in the skull (it has already been pointed out that the few specimens listed are not aged animals) and long tails are beginning to appear. At Lat. 10° N. the nominal race *R. r. tikos* with three pairs of pectoral mammæ occurs although this character, like the colour, is unstable. *Tikos* is an insignificant link between *jalorensis* in the south and *thai*, the range of which is not yet known in any detail, in the north.

### 3. *Rattus rattus jalorensis* > *rhionis* Thos. and Wrought.

*Rattus rattus rhionis* Thomas and Wroughton, Ann. Mag. Nat. Hist. (8), iii, 1909, p. 441 (Bintang Island, Rhio Archipelago).

It has already been pointed out<sup>1</sup> that rats in south Johore are conspicuously darker on the back than *jalorensis* and thus approach *rhionis* of the eastern islands in the Rhio Archipelago although they do not attain the large average size of that form (occipito-nasal length of ten adults of *rhionis* 43–45 mm.).

The exact distribution of these darker animals has yet to be worked out. In the territory of Malacca, at Segamat in north Johore, and at Leman Point on the east coast of the State *jalorensis* occurs, but the form found at Tanjong Penang on the south bank of the Lebam estuary, at Pasir Gudang and Tanjong Gomok on the north bank of the Johore Strait, and at Pelepak in south Johore is > *rhionis* as are a few skins merely labelled "Kota Tinggi."

*Ecology.* On the mainland all the rats described above are found in forest land, including mangrove forest, and to a lesser extent in secondary jungle, on both sides of the Peninsula and throughout its length, but they seem to be less common in their natural habitat than are the rats described below in theirs. Essentially lowland animals they have not been collected above 3000' although examples are known from 2000' in Perak and from between 2000–3000' at the Semangko Pass (now better known as "the Gap") on the Selangor-Pahang boundary. It is noteworthy that no field-rat of this species has ever been recorded from Singapore Island.

1. Chasen and Kloss, Bull. Raff. Mus., 5, 1931, p. 76.



*Rattus rattus jalorensis*

LOCALITY	Sex	EXTERNAL MEASUREMENTS						SKULL							Reg. No.		
		Head and body	Tail	Hind-foot	Ear	Percentage of tail to head & body	Greatest length (occipitonasal)	Condylar length	Greatest zygomatic breadth	Post-molar length	Length of a nasal	Palatilar length	Length of diastema	Anterior palatal foramina		Upper molar row	
<i>Above Lat. 4° N.</i>																	
Taiping, Perak	♂	175	179	32	20	102	40.5	35.5	18.8	18	13.7	19.5	10.9	7.3	6.5	2049-11	
Kledang Hill, Perak	♂	166	191	32	21	115	43	37.6	20.6	18.1	15.5	20.8	12.1	7.6	7	4257	
"	♂	169	193	33	21	114	44.3	38.4	20.3	18.4	16	21.4	12.3	7.7	7.2	4258	
The Dindings	♀	170	173	33	22	102	40.7	35.9	19.4	17.6	14.7	19.5	11	7.2	7	1887-09	
"	♂	168	160	35	22	95	42.4	37.5	19.4	18.4	15.5	21.2	12.3	7.2	6.5	1889-09	
"	♂	171	165	33	20	96	41.8	36.3	19.1	18.1	14.6	19.9	11.6	7.2	6.5	1885-09	
<i>Below Lat. 4° N.</i>																	
Bentong, Pahang	♂	176	155	27	19	88	40.6	36.2	19.4	18.1	13.7	20.2	11.2	7.9	6.5	1855-10	
Kuala Lumpur, Selangor	♂	169	161	30	22	95	40.5	36	18.4	17.5	14.5	19.5	11	7	6.7	2136-08	
"	♀	170	180	31	..	106	42.3	37.4	20.7	18.7	15.1	20.3	11.7	7.5	7	2140-08	
"	♀	159	178	30	20	112	41.9	35.7	..	17.5	15	20.1	11.7	7.5	6.3	1117-07	
"	♀	164	180	32	17.5	110	42.8	37.4	19.5	18.7	14.9	20.4	11.8	7.6	6.7	2138-08	
"	♀	165	167	30	20	101	40.7	34.8	19.3	17.3	14.7	18.7	10.7	7.2	6.5	1076-07	
"	♀	167	172	33	22	103	42	36.1	20.1	17.3	14.7	20.1	12	7.7	6.5	376-12	
Klang, Selangor	♂	163	182	29	19	112	40	35.4	18.5	18	14	18.7	10.7	6.7	6.5	2546-10	
Nyalas, Malacca	♂	172	185	32	20	107	40.8	35.4	18.9	17.1	14.4	19.5	11	7.2	7.1	2545-10	
"	♂	154	179	33	20	116	40.5	35.1	18.3	17.5	14	19.2	10.7	6.7	6.3	2547-10	

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## *R. rattus jalorensis*

## *Rattus rattus jalorensis* > *tikos*

LOCALITY	Sex	EXTERNAL MEASUREMENTS					SKULL								Reg. No.	
		Head and body	Tail	Ear	Hind-foot	Percentage of tail to head & body	Greatest length (occipitonasal)	Condylar length	Greatest zygomatic breadth	Post-molar length	Length of a nasal	Palatilar length	Length of diastema	Anterior palatal foramina		Upper molar row
<i>About Lat. 8° N.</i>																
Ghirbi, Peninsular Siam	♂	158	176	32	17	111	40.7	35	19.4	17.1	15.2	19.3	10.6	6.9	7	77-18
"	♂	168	198	35	22	118	41.1	36.3	19.7	18.1	14.4	19.3	11.1	7.3	6.7	56-18
"	♀	160	196	34	21	122	42.6	36.7	19.2	18	16.1	19.9	11.5	7.8	6.7	67-18
"	♀	170	200	35	21	118	44.4	37.7	19.8	18.9	15.8	20.5	11.5	7.7	6.9	73-18
<i>Small adults</i>																
Temengoh, Upper Perak	♂	165	173	32.5	19	105	39.1	34.2	18.6	16.8	13.1	19	10.3	6.1	6.6	2054-11
Bukit Jong, Trengganu	♀	155	161	29	16	104	39.3	34.5	..	17.1	13.3	18.5	10.8	6.6	6.3	2343-10
Taipang, Perak	♀	155	165	33	20	106	37.7	32.6	17.8	15.6	13	17.9	10	6.7	6.5	2051-11
Semangko Pass	♀	..	..	..	..	..	38.5	34.3	18.7	17.1	12.7	18.6	10	6.4	6.7	2244-07
Segamat, Johore	♂	159	161	29	16	101	..	33.6	19	16.7	13.5	18.6	10.2	6.9	5.9	1087-11

4. *Rattus rattus form diardi*. The House Rat.

*Mus diardii* Jentink, Notes from the Leyden Museum, ii, 1879, p. 13 (west Java).

*Mus griseiventer* Bonhote, Fasciculi Malayenses, Zool., pt. 1, 1903, p. 30; pls. ii, fig. 3 and iv, fig. 5 (Bidor, south Perak).

*External characters.* A larger and more robustly built rat than *R. r. jalorensis*. The pelage less sleek and harsher; the hair on the under parts often very coarse and semi-spinous.

In the colour of the upper parts individuals of *diardi* are often very close to *jalorensis* but there are average differences that stand out in series. *Jalorensis* is, typically, very finely grizzled above with a tendency to become blackened along the spine: *diardi* is paler and more uniform with a coarse, indefinite streaking replacing the fine obvious grizzle. The under parts are never white and never sharply defined, on the flanks, against the colour of the upper parts. The colour of the under parts is very variable: the range has been well described by Kloss<sup>1</sup> as "buffy-white, buffy, fawn, pale grey, dark smoky grey, isabelline, rusty, drab, hair-brown, or combinations of these; frequently one colour is washed with another; sometimes there is a dark gorget and a dark median line down the abdomen." The feet are sometimes white, sometimes dark brown: often they are pale with a dark median area. Tail entirely black; half-way along its length the rings 9 to 11 to the centimetre but the larger number only in exceptionally small rats. Tail usually slightly longer than the head and body but sometimes slightly shorter: on the available series its length relative to that of the head and body very slightly greater than in *jalorensis*.

*Size.* In the table of measurements on page 17 the eleven largest animals available are included all with the greatest length of the skull over 43 mm. but many other adults with worn teeth are smaller than these. These latter are compared with the former in the following table. The measurements are in millimetres with some averages in brackets.—

Dimensions	Largest adults (skull over 43 mm. in greatest length)	26 smaller adults	2 exceptionally small adults
<i>External.—</i>			
Head and body ..	178–205 (189)	160–195 (172)	150–155 (152.5)
Tail ..	190–231 (206)	178–212 (187)	175 (175)
Hind-foot ..	34–39 (36.2)	33–39 (34.7)	32–34 (33)
Ear ..	20–25 (21.8)	19–23 (20.6)	19–20 (19.5)
Percentage of tail to head and body ..	93–119 (110)	96–119 (108)	113–117 (115)

1. "Some Rats and Mice of the Malay Archipelago", Treubia, 11, 1921, p. 121.

# ON THE FORMS OF RATTUS RATTUS

Dimensions	Largest adults (skull over 43 mm. in greatest length)	26 smaller adults	2 exceptionally small adults
<i>Skull.</i> —			
Occipito-nasal length ..	43.2-45.8 (44.4)	41.2-42.9 (42)	39.3-39.4 (39.3)
Condyllo-basilar length ..	37.8-40.7	..	34.3-34.5
Greatest zygomatic breadth ..	19.9-22.4	..	18.4-19.5
Post-molar length ..	18.9-20.3	..	16.9-17.6
Length of a nasal ..	15.1-17	..	13.3-13.5
Palatilar length ..	20.1-22.5	..	17.1-19
Diastema ..	11-12.8	..	10.2-10.5
Anterior palatal foramina	7.5-8.7	..	6.7-8.4
Upper molar row ..	6.6-7.4	..	6.2-7.1

Combining the above measurements we get the following ranges for adults of *R. r. diardi* in the Malay Peninsula. The minima can, I think, be regarded as exceptionally small.

Head and body ..	..	150-205 (175.7)
Tail ..	..	175-231 (190.5)
Hind-foot ..	..	32-39 (35)
Ear ..	..	19-25 (20.8)
Percentage of tail to head and body	..	93-119 (108.8)
Occipito-nasal length ..	..	39.3-45.8 (42.5)
Condyllo-basilar length ..	..	34.3-40.7
Greatest zygomatic breadth ..	..	18.4-22.4
Post-molar length ..	..	16.9-20.3
Length of a nasal ..	..	13.3-17
Palatilar length ..	..	17.1-22.5
Diastema ..	..	10.2-12.8
Anterior palatal foramina ..	..	6.7-8.7
Upper molar row ..	..	6.2-7.4

*Mammæ.* The number seems to be constant and the same as in *R. r. jalorensis*. All females examined have two pairs of pectoral and three pairs of inguinal mammæ making ten teats in all.

*Characters of the skull.* The skull is normally larger than that of *jalorensis* and more variable in detail. The palatal foramina are especially variable in shape and size: they encroach on the palate between the molars rather more frequently than in *jalorensis*. But the nine dimensions of the skulls of the animals listed in this paper, together with some additional *diardi*, adult but rather smaller than those mentioned on p. 17, examined with

a slide rule, reveal no variation in the average relative proportions of the skulls of the two forms greater than about one per cent. When skulls of equal size of the two forms are compared that of *diardi* is often, although not always, the younger but there appears to be no difference of racial value.

*Range in the Malay Peninsula.* This rat is probably to be found in suitable situations throughout the whole length and breadth of the Malay Peninsula, but, owing no doubt to the luck of collecting, the collections examined contain no specimens from Peninsular Siam, Kedah, Kelantan, Trengganu, Pahang, Negri Sembilan and Malacca. Specimens have been examined from Pelarit, Perlis; Penang Island; Bagan Datoh, Krian Road, Taiping, Kledang Hill, and the Larut Hills in Perak, Kuala Selangor, Klang Gates, Kuala Lumpur and Rawang in Selangor; and many localities in Johore. Very common in Singapore. The small islands in the Straits of Malacca are represented only by some specimens from the coastal islet of Pulau Angsa off the coast of Selangor. This form has ascended the hills wherever there are human settlements but I have not yet seen a specimen taken above 3,000 feet.

*Ecology.* Essentially a house-rat but also found in cultivated areas in the immediate vicinity of permanent human settlements. It is, in fact, semi-parasitic on man. In the neighbourhood of settlements it can sometimes be trapped side by side with *R. r. jalorensis* but it seems never to be found in primary forest of any kind. In Perak specimens have been trapped in company with *R. r. argentiventer* (*vide infra*).

*Note.* Dark-bellied house-rats from the inland rural districts of the Malay States seem exactly like those occurring in Malayan ports and similar animals can also be trapped on ships coming into Singapore: all seem identical with the house-rat of Java which island is the type locality of *diardi*.

A much accepted view is that the white-bellied races of *R. rattus* are indigenous in the country in which they are found and that the dark-bellied forms are often, at least in part, derivatives now semi-parasitic on man. *R. r. diardi* may therefore be Malaysian in origin but we have no proof that this is the case and I have not yet seen an intermediate between it and *jalorensis*. We know that it is carried about by shipping and it may therefore be an immigrant but we also know that it is not identical with the dark-bellied rat of Ceylon, *Rattus rattus kandianus* var. *nemoralis* Blyth, from which it differs among other characters, in its larger feet.

# ON THE FORMS OF RATTUS RATTUS

## *Rattus rattus f. diardi*

Locality	Sex	EXTERNAL MEASUREMENTS						SKULL							Reg. No.	
		Head and body	Tail	Hind-foot	Ear	Percentage of tail to head & body	Greatest length (occipito-nasal)	Condylar length	Greatest zygomatic breadth	Post-molar length	Length of a nasal	Palatinal length	Length of diastema	Anterior palatal foramina		Upper molar row
<i>Largest adults:—</i>																
Penang Island ..	♂	200 imp.		37	21	..	45.8	40.7	22.3	20.3	16.4	22.2	12.8	8.5	7.4	349
Mt. Kledang, Perak	♂	178	197	37	21	111	43.5	37.8	19.9	18.9	16	20.3	11.3	7.5	7	4260
Taipang, Perak ..	♂	191	204	36	25	107	44.4	38.5	20.6	19.3	15.3	21.8	12	7.5	6.9	605-13
Bagan Datoh, Perak	♂	180	203	37	22	113	44.6	38.7	20.9	19.5	15.4	21	12.2	8.7	6.6	581-13
"	♀	198	231	39	23	117	45.3	39.7	22.4	20.1	16.4	22	12.3	8.5	7.2	582-13
Kuala Selangor ..	185 imp.			36	25	..	44.6	40	..	19.7	17	22.5	12.8	8.7	7.1	1314-08
South Johore ..	♀	205	190	37	20.5	93	45.1	39.2	..	20	15.7	20.6	12.3	8.3	6.7	2539-08
"	♂	187	222	35.5	20.5	119	44.7	39.5	20.2	20.3	15.5	21.3	12.2	7.8	..	1668-08
"	♀	180	193	34.5	20	107	43.2	37.9	20.5	19.3	15.1	20.1	11	7.7	7.2	1668-08
Singapore Island	♀	191 imp.		34	21	..	44.3	38.8	..	19.5	15.9	21.2	12.3	8.4	7.1	4265
"	♀	181	206	36	21	114	43.6	38.6	20.8	19.7	15.2	20.5	11.5	7.6	7.2	4267

5. *Rattus rattus* subsp. Ship-rats.

Rats of foreign origin are brought to the ports of the Malay Peninsula by ships coming from all directions and follow subsidiary routes of commerce to remoter parts of Malaysia. Even from Christmas and Cocos Islands I have seen very dark, long-tailed rats which, if not true *R. r. rattus*<sup>1</sup> are very near to that form: similar examples have also been trapped on the ship trading between Singapore and Christmas Island. A few other specimens taken in warehouses at the Singapore Docks and trapped in the port on ships from Calcutta, Bangkok and elsewhere are not so blackened on the upper parts which are blackish brown: on the under parts they are slaty in colour, sometimes washed with buff. The pelage also varies in character: sometimes the fur is short and sleek, sometimes harsh and spiny. As is often the case in ship-rats it seems impossible definitely to refer such animals to either *r. rattus* or *r. alexandrinus*<sup>2</sup>.

Less common locally are individuals in which white underparts are sharply contrasted against pale brown upper parts but such specimens are occasionally brought to Singapore on ships or are trapped on the island: they also occur in Bangkok. These rats are the ocean-going "*frugivorus*" if not identical with the wild rate of the Mediterranean countries:<sup>3</sup> they are not white-bellied examples of *R. r. kandianus* (Kelaart), a white bellied rat occurring in houses in Ceylon.

It is noteworthy that these ship-rats are seldom obtained even in likely localities on shore in the port of Singapore. According to Kopstein<sup>4</sup> a similar state of affairs obtains in the

1. According to Wood-Jones ("Coral and Atolls") on one of the islands of the Cocos-Keeling group the whole colony of rats consists of black rats which also turn up, as stragglers, on some of the other islands.

2. I have been fortunate in obtaining the co-operation of Dr. A. W. J. D'Cruz, the Port Health Officer of Singapore and have examined many rats caught on ships and in the Port.

3. This is not the place to discuss the systematic status of the immigrant *rattus* rats which has been conveniently summarized by Hinton in Journ. Bomb. Nat. Hist. Soc., xxvi, 1918, pp. 63-68 and British Museum (Natural History), Economic Series, No. 8, pp. 2-5. This author notices that the three colour phases may exist in one colony, that they may occasionally occur in the same litter in colonies of mixed origin and yet each has a certain geographical value and each will breed true to type under favourable conditions. All three have been carried by human agency to various parts of the world: a large percentage of ship-rats is composed of the races *frugivorus* and *alexandrinus*.

4. See 4 above.

ports of Java. The rats apparently dislike leaving their restricted stations: if they land, it seems that they cannot survive, racially at least. Exceptionally long tails and dark bellies, not uncommon among the resident house-rats of Malayan ports may possibly indicate the recessive characters of immigrants.

6. *Rattus rattus form argentiventer*. The Rice-field Rat. *Epimys rattus argentiventer* Robinson and Kloss, Journ. Straits Br., Royal Asiat. Soc., 73, 1916, p. 274 (Pasir Ganting, west coast of Sumatra).

*Rattus rattus argentiventer*, Rob. and Kloss, Journ. F.M.S. Mus., viii, pt. 2, 1918, p. 55.

*Rattus argentiventer*, Chasen and Kloss, Journ. Malay. Br., Royal Asiat. Soc., vi, 1929, p. 47.

*External characters*. Like *R. r. diardi* this is a larger form than *jalorensis*. As could be expected of a field-rat it has the smooth pelage of *jalorensis* rather than the coarse pelage of *diardi* and unlike the latter the under parts, as in *jalorensis*, seem never to be semi-spinous.

In colour *argentiventer* is distinctive, differing from both *jalorensis* and *diardi* above and below. The upper parts are coarsely and boldly grizzled with a tendency to blackening along the middle line. The under parts, in the great majority of specimens, are of a peculiar, very pale grey: they could be described alternatively as white, overlaid with silver, and quite unlike the heavy drab and grey under side of *diardi* and the dead white, or, more rarely, white sullied with dull grey, of *jalorensis*. In a few specimens, the underparts are white. More often than not there are in *argentiventer* faint indications of a darker gorget and middle line.

Feet always mostly dark.

Tail black throughout: half-way along its length the rings 9 to 11 to the centimetre. Relative length of the tail as in *jalorensis* and on series a trifle shorter than in *diardi*.

This rat is perhaps less stable in colour than either *jalorensis* or *diardi*: the relatively small number examined has already produced a pure albino; a variety creamy-fawn above and white below; and a third specimen tending to melanism on the upper parts.

*Size*. The measurements in millimetres of nineteen good adults with worn teeth from a limited locality in Perak are given



in detail on page 24 and summarized below: some averages are given in brackets.

Head and body	..	..	160-194 (178)
Tail	..	..	165-210 (185)
Hind-foot	..	..	34-41 (36.5)
Ear	..	..	20.-24.5 (22.5)
Percentage of tail to head and body			97-113 (104)
Occipito-nasal length	..	..	40.4-45.8 (42.2)
Condyllo-basilar length		..	35.3-39.7
Greatest zygomatic breadth	..		19.4-21.8
Post-molar length	..	..	17.2-19.8
Length of a nasal	..	..	14.2-17.5
Palatilar length	..	..	19.2-22.1
Diastema	..	..	10.6-12
Anterior palatal foramina	..		6.7-8.5
Upper molar row	..	..	7.1-7.9

*Mummae*. *R. r. argentiventer* differs from *jalorensis* and *diardi* in the possession of three pairs of pectoral mammae making twelve teats in all.

*Characters of the skull*. The skull differs from that of *jalorensis* in its larger size but in its major proportions it is almost identical except that the tooth-row is slightly longer averaging about 20% of the condyllo-basilar length instead of about 18% shewn by long series of *jalorensis*. It also differs in that in all the specimens examined a line drawn across the anterior roots of  $M^1$  invariably includes the tips of the anterior palatal foramina for a length of up to 1.5 mm. Other marked actual differences not correlated with the difference in size between the skulls of the two forms are that in *argentiventer* the infra-orbital plate is broader; the teeth, including the incisors, are larger; and the bullae are much larger, more dilated. The skull is more like that of *diardi* because of the closer approximation in size but the points of distinction mentioned above with regard to *jalorensis* apply equally well to *diardi* with the exception of that concerning the relation of the palatal foramina to the inter-molar space, which as already noted above is a very variable character in *diardi*.

*Range in the Malay Peninsula*. The great majority of the specimens examined is from the rice-fields of Krian, northwest Perak (Bagan Tiang, Parit Buntar, Briah, Tanjong Piandang, Kuala Kurau, Bagan Serai, Gunong Semanggol, and Selensing. There are also specimens from Krian Road near Taiping; from Rubana Estate near Telok Anson<sup>1</sup>; and from Rungkup Estate,

1. See L. Wray, "Notes on the Sugar Cane Rat", (referred to *jalorensis*) in Journ. F.M.S. Mus., 2, 1905, p. 39.

Bagan Datoh in Lower Perak. To the north I have traced this form to Kedah Peak; Bangnara on the coast of Patani, Peninsular Siam; and to Bangkok. South of Perak I know it only from Cheras, near Kuala Lumpur in Selangor.

*Ecology.* The Rat Destruction Officer, Krian, Perak, has kindly forwarded some interesting notes on the habits of this rat. It lives in the open rice-fields feeding freely on the growing rice crops, grasses, roots and insects, especially grasshoppers. The breeding season is, generally speaking, from the beginning of harvest until late July or August, but it depends largely on the supply of food available. The early nests are in the dry grass ridges round the open fields but when the country becomes flooded the rats nest in and around the nipah palms away from villages and along the earth bunds. The average litter in 1932 was ten. Unlike *diardi* the rice-field rat does not infest villages.

*Note.* The rice-field rat of the Malay Peninsula is here referred to *R. r. argentiventer* Rob. and Kloss, but the identification needs confirmation as *argentiventer* is only definitely known from the west Sumatran type and unique specimen not now available for examination. The published measurements of the type together with those of a single specimen from eastern Borneo referred to the same form, again without direct reference to the type, are given at the bottom of the table on p. 23.

It will be noticed that the type, said to be an adult with worn teeth, has a smaller hind-foot and a tail relatively a trifle shorter than any of the Malayan specimens. The Bornean specimen is even shorter in the tail than the type but this may be due to the method of measuring in the flesh: otherwise, as far as a badly smashed skull will allow comparison, it only differs from some Malayan examples in its darker underparts.

In Java the rice-field rat *R. rattus brevicaudatus* Horst and De Raadt, and the field-rat, *R. r. roquei* present almost the same points of distinction as do *argentiventer* and *jalorensis* in the Malay Peninsula although between these last mentioned forms there is no difference in the relative length of tail. Normally, *R. r. roquei* has white under parts, two pairs of pectoral mammæ, and the comparative characters of a long tail and small bullæ: *brevicaudatus* has the under parts washed with silvery grey and three pairs of pectoral mammæ; the tail is comparatively short and the bullæ large.

Until a series of topotypical *argentiventer* is available for comparison it is impossible to proceed further with the systematics of these rats beyond remarking that Malayan *argentiventer* and typical *brevicaudatus* of Java seem very close. On published figures the latter has a relatively slightly shorter tail

(80–105% of the head and body) but I have never seen a really good series of adults from Java. One of these forms is no doubt the same as true *argentiventer* (1916) of Sumatra, which name has priority over *brevicaudatus* (1918). By analogy, Sumatran and Malayan animals are most likely to belong to the same race and are here so regarded, but the Bornean race could be either *argentiventer* or *brevicaudatus*.

I can see no justification for applying a simple trinomial nomenclature to this group of rats. Most zoologists now define a subspecies as a geographical race although many, especially some ornithologists, take a very broad view about these races and regard as subspecies certain forms now overlapping in range, and in extreme cases perhaps even breeding in the same area: in any case it is always contended that the differences were, and still are, mainly geographic in value. On this view the three forms of *R. rattus* indigenous in Europe can fairly be regarded as subspecies but in the Malay Peninsula the case is not parallel. Three distinct rats occupy three different types of country, sometimes in close proximity: the differences in their ranges are only geographical in the remotest sense and purely ecological and there seems no reason to make an exception to the custom of nomenclature in their favour. The system of naming here adopted is therefore a departure from precedent in this particular case.

The view that both *diardi* and *argentiventer* are derivatives of *jalorensis* and now semi-parasitic on man may be correct for it is significant that neither is found in virgin country: but *diardi* might also well be of foreign origin. Since the recognition of *argentiventer* all the *rattus* rats seen from the Peninsula are definitely referable to one of the three forms and although the differences between these forms are as well marked as those separating many "species" they cannot be regarded as such because of the peculiarly restricted nature of their habitat.

# ON THE FORMS OF RATTUS RATTUS

## *Rattus rattus f. argentiventer*

Locality	Sex	EXTERNAL MEASUREMENTS					SKULL								Reg. No.	
		Head and body	Tail	Hind-foot	Ear	Percentage of tail to head & body	Greatest length (occipitomassal)	Condylar length	Greatest zygomatic breadth	Post-molar length	Length of a nasal	Palatilar length	Length of diastema	Anterior palatal foramina		Upper molar row
Perak	♂	192	197	37	20	103	42.2	37.6	21.1	18.4	14.4	20.6	11.8	7.7	7.2	4250
"	♀	186	191	36	21	103	43.3	37.5	21.3	17.9	15.4	20.5	12	7.6	7.3	4249
"	♂	185	180	36	20	97	42	37.3	20.5	18.4	14.9	20.2	11.3	7.7	7.4	4262
"	♀	170	166	34	22	98	42.9	37.7	21.4	18.7	14.7	20.3	11.3	7.5	7.5	4254
"	♂	185	210	39	21	113	45.8	39.7	21.8	19.8	17.5	22.1	11.9	8.3	7.7	125
"	♂	180	185	36	22	103	42.2	37.1	19.7	18.3	14.4	20.2	11	7.2	7.5	274-32
"	♂	194	200	41	24	103	44.6	39.1	20.8	19.3	15.1	20.9	12	8.5	7.6	249-32
"	♂	180	200	38	23	111	..	38	19.9	18.1	..	20.6	12	8	7.7	273-32
"	♂	178	185	38	23	104	40.7	..	20.3	..	14.4	20	11.3	7.9	7.4	278-32
"	♂	178	194	36	23	109	41.8	37	20.7	18.2	15	20.2	11.3	7.3	7.1	242-32
"	♂	192	190	40	24.5	99	42.9	38	20.3	18.3	14.9	21.2	11.7	8.2	7.5	232-32
"	♂	178	190	37	24	107	41.9	35.3	19.5	17.2	14.8	19.3	10.6	7.7	7.1	234-32
"	♀	160	165	35	23	103	40.4	36.8	19	17.9	14.2	20	11.7	6.7	7.2	214-32
"	♀	172	175	36	23	102	41.8	36.7	20.7	17.3	14.6	20.5	11.4	7.7	7.7	272-32
"	♀	180	188	36	25	104	..	36.7	20.5	17.7	..	20.1	10.9	7.6	7.6	257-32
"	♀	170	180	34	22	106	43	38	21	18.4	14.8	21	11.8	8.1	7.1	223-32
"	♀	165	170	35	22	103	40.6	35.9	19.4	17.5	14.5	19.2	10.7	7.1	7.3	290-32
"	♀	165	175	35	23	106	41.1	36.7	20	17.8	14.3	20	11.3	8.1	7.2	276-32
"	♀	165	180	36	22	109	41.4	36.6	20.1	17.7	14.9	20.3	11	7.9	7.9	294-32
"	♂	184	173	32	20	94	41	36.2	19.8	..	14.7	..	11	8.5	7.9	602-14
Korinchi, W. Sumatra	♀	174	159	34	..	90	..	..	18.7	..	13.8	18.1	10	7.7	7.2	..
East Borneo	♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

## Summary (Adults)

CHARACTER	R. JALORENSIS	R. ARGENTIVENTER	R. DIARDI
General ..	A lightly built rat with sleek pelage	More heavily built with sleek pelage	Like <i>argentiventer</i> but pelage harsher: on the under parts often coarse and semi-spinous
Colour of upper parts ..	Finely grizzled	Coarsely and boldly grizzled	Paler and more uniform with a coarse, indefinite streaking
Colour of under parts	White, sharply defined on the flanks: sometimes clouded with dull grey	White, overlaid with silver: sharply defined on the flanks	Never white but grey to brown: not defined but merging with the dark upper parts on the flanks
Head and body in mms ..	154-176 (165.6) 155-193 (173)	160-194 (178) 165-210 (185)	150-205 (176.7) 175-231 (190.5)
Tail ..	88-115 (104.5) 27-35 (31.4)	97-113 (104) 34-41 (36.5)	93-119 (108.8) 32-39 (35)
Percentage of tail to head ..	16-22 (19.8)	20-24.5 (22.5)	19-25 (20.8)
Hind-foot s.u. ..	37.7-44.3 (40.9)	40.4-46.8 (42.2)	39.3-45.8 (42.5)
Ear ..	In the great majority of skulls a line drawn across the anterior roots of M1 excludes the palatal foramina	Larger. Toothrow relatively slightly longer	Skull as in <i>jalorensis</i> but larger and more variable in detail. Palatal foramina especially variable
Greatest length of skull ..			
Characters of skull ..			
Mammæ ..	2 : 3	3 : 3	2 : 3
Habitat ..	Forest of all kinds	Rice-fields	Associated with man. In houses, villages, etc.

## Notes on A Small Collection of Marine Copepoda from the Malay States

By R. B. SEYMOUR SEWELL, M.A., SC.D., F.A.S.B., LIEUT.-COL., I.M.S.

In 1928 a small collection of Copepoda from the sea off Penang and the Kurau river, Perak, was submitted to me for examination and identification by Mr. Cedric Dover then attached to the Malayan Museums Department. In this collection the following species were represented.

### CALANOIDA

#### Tribe Amphaskandria

#### Family EUCALANIDAE

##### Genus *Eucalanus* Dana

##### *Eucalanus subcrassus* Giesbrecht

*Eucalanus subcrassus*, Sewell, 1929, p. 51.

*Eucalanus subcrassus*, Menon, 1931, p. 509.

Examples of this species were taken in the following localities:—

- (a) Kurau river, Stations 11–12, 3. iii. 28.
- (b) Kurau river, Stations 56–64, 3. iii. 28.
- (c) Sea off Penang, 5. iii. 28.

Adult forms were taken in both (a) and (b) but only young forms were present in the third collection from the sea. As I have pointed out (*loc. cit.*, p. 52) “this species is widely distributed throughout Indian waters and at least in certain areas is extremely common.” Menon (1931, p. 508), however, states that in Madras it is not so common as *Eucalanus crassus* Giesbrecht.

#### Family PARACALANIDAE

##### Genus *Paracalanus* Boeck.

##### *Paracalanus crassirostris* Dahl.

*Paracalanus crassirostris*, Sewell, 1929, p. 73, fig. 27.

Examples of this species were taken at the following stations:—

- (a) Kurau river, Stations 11–12, 3. iii. 28.
- (b) Kurau river, Stations 17–26, ..
- (c) Kurau river, Stations 56–64, 3. iii. 28.
- (d) Sea off Penang, 5. iii. 28.

This species is for the most part an inhabitant of brackish and estuarine waters and the littoral region, where the salinity of the water tends to be somewhat lower than that of the open

sea. The species appears to have a wide distribution and it is possible that there are several local races in different parts of the world.

**Genus *Acrocalanus* Giesbrecht.**

***Acrocalanus inermis* Sewell.**

*Acrocalanus inermis*, Sewell, 1929, p. 81.

Examples were taken at the following stations:—

- (a) Kurau river, Station 17-26, . . .
- (b) Kurau river, Station 42-53, 4. iii. 28.
- (c) Kurau river, Station 56-64, 3. iii. 28.

This species appears to be widely distributed in brackish-water around the coasts of the Bay of Bengal and the Malay Archipelago.

***Acrocalanus gibber* Giesbrecht.**

*Acrocalanus gibber*, Sewell, 1929, p. 80, fig. 32.

This species was taken at the following stations:—

- (a) Kurau river, Stations 56-64, 3. iii. 28.
- (b) Sea off Penang, 5. iii. 28.

This species is of almost universal occurrence throughout the coastal regions of the Bay of Bengal and the northern part of the Indian ocean.

**Tribe *Heterarthrandria***

**Family CENTROPAGIDAE**

**Genus *Centropages* Herrick.**

***Centropages furcatus* (Dana).**

*Centropages furcatus*, Sewell, 1932, p. 229.

*Centropages furcatus*, Menon, 1931, p. 509.

Examples were taken at the following station:—

- (a) Sea off Penang, 5. iii. 28.

This species is widely distributed throughout Indian waters and the Malay Archipelago, and, so far as my experience goes, is the most common member of the genus.

***Centropages kroyeri* Giesbrecht.**

*Centropages kroyeri*, Sewell, 1932, p. 230.

A single example, male, of this species was taken in the tow-netting from Kuala<sup>1</sup>, Kurau river, Stations 54-64, 3. iii. 28.

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1. Kuala = mouth of a river.

Family DIAPTOMIDAE

Genus *Pseudodiaptomus* Herrick.

*Pseudodiaptomus aurivillii* Cleve.

*Pseudodiaptomus aurivillii*, Sewell, 1932, p. 240, fig. 85, a

Examples occurred at the following stations:—

- (a) Kuala, Kurau river, Stations 56–64, 3. iii. 28.
- (b) Kurau river, Stations 42–53, 4. iii. 28.
- (c) Sea off Penang, 5. iii. 28.

This species is distributed throughout the Malay Archipelago and the eastern and northern parts of the Bay of Bengal.

*Pseudodiaptomus mertoni* Früchtl.

*Pseudodiaptomus mertoni*, Sewell, 1932, p. 241, fig. 85 b.

This species is liable to be mistaken for the preceeding form. Examples were taken, along with *Pseudodiaptomus aurivillii* Cleve, at Kuala, Kurau river, Station 26, 22. iv. 26.

*Pseudodiaptomus daughlishi* Sewell.

*Pseudodiaptomus daughlishi*, Sewell, 1932, p. 241, fig. 86.

This species was taken in an almost pure culture at Kuala, Kurau river, Station 26, 22. iv. 26.

*Pseudodiaptomus* sp. juv.

A few immature examples of a species of *Pseudodiaptomus* were taken in the Kurau river, Station 56–62, 3. iii. 28.

Family TEMORIDAE

Genus *Temora* Baird.

*Temora stylifera* (Dana).

*Temora stylifera*, Sewell, 1932, p. 246.

Examples were taken in the Kurau river at Stations 42–53, 4. iii. 28. The species is widely distributed throughout the Indian Ocean.

*Temora turbinata* (Dana).

*Temora turbinata*, Sewell, 1932, p. 246.

*Temora turbinata*, Sewell, 1932, p. 246.

A few examples of this species were taken with the preceeding form in the Kurau river, Station 42–53, 4. iii. 28.

Like the former species this is widely distributed throughout the Indian Ocean and, according to Menon, is the commonest form of *Temora* in the Madras plankton.



Family PONTELLIDAE

Genus *Labidocera* Lubbock.

*Labidocera euchaeta* Giesbrecht.

*Labidocera euchaeta*, forma *minor*, Sewell, 1932, p. 362.

Examples of this species were taken in the Kurau river at Station 11-12, 3. iii. 28.

This was the form originally described by Giesbrecht; the form that I previously associated with this under the name *Labidocera euchaeta* forma *major* is almost certainly a different species and not a dimorphic form. Both species appear to be inhabitants of brackish and estuarine waters.

*Labidocera kroyeri* (Brady).

*Labidocera kroyeri*, Sewell, 1932, p. 362.

Examples were taken in the Kurau river at Stations 11-12, 3. iii. 28.

This species is widely distributed throughout Indian waters and the Malay Archipelago. A number of varieties have been described.

*Labidocera pectinata* Thompson and A. Scott.

*Labidocera pectinata*, Sewell, 1932, p. 372, fig. 124.

Examples were obtained at the following stations:—

(a) Kurau river, Stations 11-12, 3. iii. 28.

(b) Kurau river, Stations 56-64, 3. iii. 28.

This species has been taken at numerous localities in the Mergui Archipelago and in the Cochin Backwaters on the west coast of India. It appears to prefer the neighbourhood of river mouths or backwaters.

Family ACARTIIDAE

Genus *Acartia* Dana.

Sub-genus *Odontacartia* Steuer.

*Acartia* (*Odontacartia*) *spinicauda* Giesbrecht.

*Acartia* (*Odontacartia*) *spinicauda*, Sewell, 1932, p. 397.

Examples were taken at the following stations:—

(a) Kurau river, Stations 11-12, 3. iii. 28.

(b) Kurau river, Stations 17-26, . . .

(c) Kurau river, Stations 42-53, 4. iii. 28.

(d) Kurau river, Stations 56-64, 3. iii. 28.

(e) Sea off Penang, 5. iii. 28.

This species is widely distributed throughout Indian waters and in the Malay Archipelago. In certain areas, such as the

estuarine region of the River Hoogli, India, it appears to be establishing itself in brackish-water.

**Acartia (Odontacartia) erythraea** Giesbrecht.

*Acartia erythraea*, Menon, 1931, p. 510.

*Acartia (Odontacartia) erythraea*, Sewell, 1932, p. 396.

Examples were taken in the tow-net from the sea off Penang, 5. iii. 28, and in the Kurau river, Stations 56-64, 3. iii. 28. The species is widely distributed throughout the Indian Ocean and the Malay Archipelago. Menon (*loc. cit.*) records that it is a very common form in the plankton off Madras.

**Acartia (Odontacartia) pacifica** Steuer.

variety *mertoni* Früchtl.

*Acartia (Odontacartia) pacifica*, Sewell, 1932, p. 397.

Specimens were obtained at the following stations:—

- (a) Kurau river, Stations 17-26, ..
- (b) Kurau river, Stations 42-53, 4. iii. 28.
- (c) Kurau river, Stations 56-64, 3. iii. 28.

**Family TORTANIDAE**

Genus *Tortanus* Giesbrecht.

Sub-genus *Tortanus* Sewell.

**Tortanus (Tortanus) barbatus** (Brady).

*Tortanus barbatus*, Menon, 1931, p. 510.

*Tortanus (Tortanus) barbatus*, Sewell, 1932, p. 399.

Examples were taken at the following stations:—

- (a) Kurau river, Stations 11-12, 3. iii. 28.
- (b) Kurau river, Stations 17-26, ..
- (c) Kurau river, Stations 56-64, 3. iii. 28.
- (d) Sea off Penang, 5. iii. 28.

In my opinion this species is identical with *Tortanus denticulatus* (Giesbrecht). It is widely distributed throughout Indian waters and the Malay Archipelago.

**Tortanus (Tortanus) forcipatus** (Giesbrecht).

*Tortanus (Tortanus) forcipatus*, Sewell, 1932, p. 399.

A few examples were taken in the following localities:—

- (a) Kurau river, Stations 42-53, 4. iii. 28.
- (b) Sea off Penang, 5. iii. 28.

The species has been taken in the Malay Archipelago, off the coast of Burma and off Ceylon.

**CYCLOPOIDA**

**Family OITHONIDAE**

Sub-family OITHONINAE

Genus *Oithona* Baird.

***Oithona brevicornis* Giesbrecht.**

*Oithona brevicornis*, Sewell, 1924, p. 792.

Examples were obtained in the Kurau river, Station 56-64, 3. iii. 28.

This species is widely distributed, having been taken in the Pacific Ocean, Malay Archipelago and in various parts of the Indian Ocean. The species appears to have a distinct tendency to invade brackish-water areas, as it has been taken in such waters in Verlaten Island, Sunda Straits; in the Chilka Lake; and in the estuarine region of the Hoogli river.

***Oithona nana* Giesbrecht.**

*Oithona nana*, Sewell, 1924, p. 791.

Examples were obtained from the Kurau river, Stations 56-64, 3. iii. 28. This species has a world-wide distribution and, like the preceding species, has a tendency to invade brackish-water areas, though its power of adaptation does not appear to be quite so marked.

**Family CORYCAEIDAE**

Genus *Corycaeus* Dana.

***Corycaeus (Ditrichocorychaeus) subtilis* Dahl.**

A number of examples of both sexes were taken in the Kurau river, Stations 56-64, 3. iii. 28.

**Family LICHOMOLGIDAE**

Genus *Macrocheiron* Brady.

***Macrocheiron* sp.**

Two species of *Macrocheiron*, both of which appear to be new, were taken in the Kurau river, one at Station 42-53, 4. iii. 28; and the second at Stations 56-64, 3. iii. 28.

**HARPACTICOIDA**

**Family ECTINOSOMIDAE**

Genus *Microsetella* Brady and Robertson.

***Microsetella norvegica* (Boeck).**

*Microsetella norvegica*, Sewell, 1924, p. 809.

A few examples were taken in the tow-net from the Kurau river, Stations 56-64, 3. iii. 28.

ON SOME NEW OR RARE SPECIES OF OSTARIOPHYSI

Family TACHIDIIDAE

Genus *Euterpina* Norman.

*Euterpina acutifrons* (Dana).

*Euterpina acutifrons*, Sewell, 1924, p. 836.

*Euterpina acutifrons*, Menon, 1931, p. 510.

Examples were taken in the Kurau river, Stations 56-64, 3. iii. 28.

This species appears to have a world-wide distribution. Menon (*loc. cit.*) notes that it is a very important constituent of the plankton of the Madras coast and is never entirely absent from it.

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**On some New or Rare Species of Ostariophysi from the Malay Peninsula and a New Species of Betta from Borneo**

By L. F. DE BEAUFORT, ZOOLOGICAL MUSEUM, AMSTERDAM

Through the kindness of the Director of the Raffles Museum, Singapore, the fish collection of that museum and also that of the Department of Fisheries of the F.M.S. was sent to me for identification. I have now finished the study of the freshwater fishes and as a first result I give here an account of some new or rare species found in these collections.

***Acanthophtalmus pahangensis* n. sp.**

D.2.8. A.1.7. P.1.8. V.6.

Elongate, much compressed. Height 5.4, 6.3 in length with caudal. Head 4.2, almost 5 in length with caudal. Eye more than 9, more than 4 in snout. Suborbital spine bifid. Six barbels, 4 rostral and 2 maxillary ones. They are subequal and about as long as snout. Origin of dorsal more than twice diameter of eye behind origin of ventrals, which are about their

own length nearer to tip of caudal than to tip of snout. Origin of anal slightly behind vertical through end of dorsal. Pectorals somewhat falciform, pointed, the second ray being produced, longer than head. Ventrals short. Posterior caudal margin somewhat concave. Coloration uniform. Length 44.5 mm.

One specimen, from "fish-drive" off Mentakab, Pahang river, Malay Peninsula, 30.5. 1929. (Fisheries No. 235).

In the position of the dorsal this species comes near to *A. kuhli* and *A. borneensis*. It differs from both, besides in the fin formulæ, in the long falcate pectorals. In this respect it agrees with *Lepidocephalus macrochir*, with which species it has more points of resemblance. It differs however by having the head scaleless, the chief difference between the two genera *Lepidocephalus* and *Acanthopthalmus*.

***Acanthopthalmus (Cobitophis) muraeniformis* n. sp.**

D.7. A.7. P.1.7. V.6.

Compressed. Height about 16, head 7 in total length. Eye about 9, placed rather high, its posterior border in middle of head. Eight barbels, as besides the usual rostral, maxillary and mandibular pair, the lower lip, which in most species of *Acanthopthalmus* is bilobed, has two distinct barbels. The distance between the origin of the dorsal and the eye is twice, or twice and a half in young specimens, as long as the distance between origin of dorsal and caudal. End of dorsal somewhat before origin of anal. Origin of ventrals about their length before origin of dorsal, situated midway between pectorals and caudal. Pectorals about equal to ventrals, almost as long as head. First branched pectoral ray thickened. Caudal truncate. Scales minute. Colour of preserved specimens pinkish. Three brown crossbars through head, the eye between the first and second, the third through operculum. Back with a series of brown blotches, broader than the interspaces and continued or irregularly broken on upper part of sides. Belly uniform. Dorsal and caudal freckled with brown, other fins hyaline.

Six specimens, 40–49 mm. long, from Thomson Rd., Singapore Island 16.5.1912. (Raffles Museum F. 739/744).

This species belongs to the section of elongate species, which has been separated by Myers as *Cobitophis*. It differs from the two other species of the group by having 8 barbels and also by the position of the dorsal, the length of the paired fins and the coloration.

***Lepidocephalus furcatus* n. sp.**

D.2.6. A.2.5. P.8.6. V.1.6.

Elongate, much compressed. Height about 5.3, 6.6 in length with caudal. Head 4.8, 6 in total length. Eyes covered by skin,

about 4 in head and 1.5 in snout. Suborbital spine bifid. Scales on head. Vertex, opercular and suborbital region scaleless. Eight barbels. The posterior rostral and maxillary ones about as long as eye, anterior rostral and mandibular barbels shorter. Origin of dorsal above that of ventrals, slightly nearer caudal than tip of snout. Height of dorsal equal to length of pectorals and slightly more than length of head without snout. Origin of anal at a distance equal to postorbital part of head behind last dorsal ray. Caudal forked. Scales minute. Colour of preserved specimens dark reddish brown, with irregular mottlings suggesting crossbands. Fins with rows of black spots. Length 33 mm.

Six specimens from Bukit Merah Reservoir, Perak, Malay Peninsula 18.7.1925. (Fisheries No. 218).

This species can be distinguished at once from other species of the genus by its forked tail.

***Paralaubuca typus* Blkr.**

*Paralaubuca typus* Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 16.

*Paralaubuca typus* Sauvage, Nouv. Arch. Mus. Paris, 2. serie, Tome 4. 1881, p. 189.

?*Paralaubuca typus* Hora, Journ. Nat. Hist. Soc. of Siam, Vol. VI, 2, 1923, p. 148. Plate 10. fig. 2.

Three specimens from "fish Drive" off Mentakab, Pahang river, Malay Peninsula, 30. v. 1927.

These specimens agree with the descriptions of the species, given by the authors cited above. They all three show more or less the doubling of the lateral line, described by Sauvage and Hora. This species was only known from Siam.

***Puntius sachsii* (Ahl)**

*Barbus Sachsii* Ahl, Zool. Anz. Bd. LVI. 1923. p. 182.

*Barbus sachsii* Ahl, Das Aquarium, October, 1929.

Five specimens from a pond at Serangoon, Singapore Island, 16. 5. 1932. (Raffles Musum F. 756/760).

Ahl did not know if his specimens came from India, the Indo-Australian Archipelago or China. The specimens from Singapore are therefore the first with a good habitat. According to Ahl, this species was introduced in Europe as an aquarium-fish as long ago as 1895.

In the largest specimen, 38 mm. long, the lateral line is complete or at least practically so, the lateral line running from head to caudal and having an interruption of one scale only at a few places. In the other specimens, otherwise perfectly similar to the former, the lateral line is only developed on the first scales.

**Lissochilus smedleyi** n. sp.

D.II.8(9). A. 3.5. P.1.15-16. V.I.8-9. LI.27-28. Ltr.  $\frac{5\frac{1}{2} - 6}{1}$   
 $4\frac{1}{2}$

Back evenly arched. Height 2.7-2.8, 3.6-3.7 in length with caudal. Head 3.9-4.5, 1-5.2 in length with caudal. Eye with a small adipose eyelid, 3.1 in head, equal to snout, which has numerous pores. Eye less than rather convex interorbital space. Rostral barbels equal to eye; maxillary barbels somewhat longer. Postlabial groove not continuous. Origin of dorsal opposite to ventrals, about midway between end of snout and base of caudal. The third simple ray strongly ossified and denticulated behind, as long as distance between anterior nostril and hindborder of operculum. Third simple ray of anal weakly ossified, about as long as the dorsal spine. Pectorals somewhat longer than ventrals, equal to head. Least height of caudal peduncle 1.3-1.4 in its length, equal to or slightly more than postorbital part of head, surrounded by 12 scales. Caudal deeply forked. Colour of preserved specimens deep brown, with light brown longitudinal series of stripes, corresponding with the rows of scales. Fins hyaline.

Two specimens, 122 and 164 mm. from Johore, Malay Peninsula.

This species is closely allied to *Poropuntius normani*, recently described by H. Smith (Proc. U.S. Nat. Mus. Vol. 79. 1931 p. 15) from Siam. This species differs from *L. smedleyi* in the following points: 14 scales round caudal peduncle, interorbital space flat, osseous part of dorsal spine equal to head less snout, ventrals and pectorals subequal 1.25 in head.

Smith created for this species the new genus *Poropuntius*, differing chiefly from *Lissochilus* by its denticulated spine. Both have a rostral groove.

I agree with Herre and Myers (Lignan Science Journal, Vol. 10. 1931 p. 244) that "the ossification of the dorsal spine cannot be accepted as a generic character to split up this group". Perhaps, when the apparently rather numerous species of this genus will be better known, it will be possible to subdivide *Lissochilus*.

Named in honour of Mr. N. Smedley, formerly Curator of the Raffles Museum.

**Leiocassis chaseni** n. sp.

D.II.6(7). A.14.(15). P.1.8. V.6.

Height 4.1, 4.7 in length with caudal. Head 3.5, 4 in length with caudal, the height about equal to the breadth and two thirds of length. Eye 3.7, less than twice in snout, 1.4 in interorbital space. Snout projecting beyond mouth, which is

transverse, slightly curved. Nasal barbels reaching front border of eye, maxillary barbels posterior border of eye, mandibular and mental ones longer than eye. Vomerine teeth in an uninterrupted band, without posterior projection. Head covered by smooth skin. Occipital process about twice as long as broad, separated from the basal shield of the dorsal spine by a distance equal to its breadth. Origin of dorsal one eye diameter nearer to tip of snout than to end of adipose fin. The dorsal spine preceded by a minute one, strong, with about 8 serræ posteriorly, as long as head without snout. Base of adipose fin longer than that of dorsal, equal to its distance from that fin. Origin of anal twice as near to base of caudal than to tip of snout. Anterior anal rays longest, scarcely shorter than head without snout. Pectoral spine strong, serrated along its inner edge, as long as dorsal spine. Clavicular process reaching to the middle of the pectoral spine. Ventrals midway between base of pectoral and end of anal, as long as snout and half eye. Caudal forked (tips broken). Colour of preserved specimen brownish, with indications of lighter patches on nape and on sides behind dorsal and adipose fin. Dorsal, anal, pectorals and ventrals smoky brown, darker at base, with a transverse colourless band in the middle, but not developed between the anterior rays. Caudal colourless, with an indication of a transverse band in the middle. The bones of the head, the dorsal and pectoral spines, and the clavicular process are bright green, but I suppose that this is due to preservation, the specimens possibly having been kept in a brass tank. The caudal fin is also stained with green. Length of single specimen 85 mm. (caudal broken).

Ulu Jelai, Pahang, Malay Peninsula, February, 1910. (Raffles Museum F. 245).

Named in honour of Mr. F. N. Chasen, Director of the Raffles Museum.

This species comes nearest to *L. baramensis* Reg. from Borneo, differing by its longer dorsal and pectoral spines, *baramensis* having less serræ. The eye is probably larger, but the difference may be due to the difference in size of the two type-specimens, that of Regan being 190 mm.

***Betta ocellata* n. sp.**

D.8. A.II.29. P.11. V.I.1-4. LI.34. Ltr.10.

Dorsal profile almost straight from dorsal to head, that of head gently curved. Height 4, 4.6 in length with caudal. Head 2.9, 3.9 in length with caudal. Eye 5, 1.6 in snout and 1.8 in flat interorbital space. Chin prominent. Maxillary reaching to below front border of pupil. Origin of dorsal slightly nearer to caudal than to head, separated by about 29 scales from snout, opposite to 19th lateral scale. First dorsal ray very short, equal



to half eye, sixth ray longest, reaching base of caudal when the fin is laid back. Anal beginning below seventh lateral scale. The fifth anal ray, counting from behind, longest, reaching to caudal. Pectorals as long as postorbital part of head. Produced ray of ventrals as long as head without snout. Caudal broadly rounded. Height of caudal peduncle 2.2 in head, much less than postorbital part of head. Colour of preserved specimen brownish gray, lighter below, operculum blackish. A black blotch, almost as large as eye, and bordered anteriorly by a white area, forming an indistinct ocellus, below the median line at base of caudal. Fins smoky brown. Pectorals white at base, the white bordered distally by a black band. Produced ray of ventrals whitish at tip. Length 99 mm.

One specimen from Bettotan near Sandakan, British North Borneo. (Raffles Museum F.1126).

This species comes nearest to *B. patoti*. It is distinguished by its much higher caudal peduncle, by its maxillary reaching front border of pupil and by its coloration. In this respect it shows resemblance to *B. unimaculata*, (Popta). This species however has no anal spines.

## On *Sacculina gordonii*, a new species of the Genus, Parasitic on *Atergatis floridus*

By H. BOSCHMA,

Professor of Zoology at the University at Leiden

Some time ago Dr. Isabella Gordon of the British Museum (Natural History) sent me for identification a specimen of a Sacculinid on *Atergatis floridus*. The specimen belongs to the collection of the Raffles Museum, and, as it proved to be the type of a new species, the description is given here together with a few remarks on the specimen.

### *Sacculina gordonii* nov. spec.

Locality: Sultan Shoal, Singapore, Adolf Monteiro coll., 27. 10. 1930; 1 specimen on *Atergatis floridus* (Rumph.).

Diagnosis of the species. Male genital organs in the posterior part of the body, outside the visceral mass. Testes completely separated, enormously enlarged, forming wide, thin-walled sacs, which suddenly pass into the vasa deferentia. One of the testes much larger than the other. Colleteric glands flattened, with a comparatively small number of tubes. External cuticle covered with hairs which have the same structure as the main layers of this cuticle. The hairs have a length of 10–20 $\mu$  and bear minute lateral hairs. Internal cuticle with narrow bands of retinacula, which are composed of one to six spindles; the latter have a length of 10–20 $\mu$  and are not barbed.

The specimen is more or less triangular with rounded angles, the anterior region forming the base of the triangle whilst the stalk is found at the apex. The surface of the mantle possesses a few folds and grooves (fig. 1), whilst at the surface which was turned against the abdomen of the host there is a short concavity caused by pressure of the surroundings of the gut of the crab against the parasite. The dimensions of the specimen are: breadth 18 mm., height (the distance between the anterior and posterior region), not including the stalk, 16 mm, and thickness 5 mm. The mantle opening, which is found in the anterior part of the surface which was turned towards the thorax of the crab, does not project noticeably above its surroundings; it forms a rather narrow slit with an irregular margin, probably owing to contraction of this part of the mantle during the preservation of the specimen.

The anatomy of the specimen could be studied by means of a series of longitudinal sections. The chief facts derived from the study of these sections are the following.

The male genital organs are found in the posterior part of the body, in the muscular region to which the stalk is attached. They lie therefore outside the visceral mass. Both testes have a greatly enlarged shape (figs. 2, 3), they form wide pouches which are provided with a thin wall. The testis of the left side is much larger than that of the right side, the greater part of the latter is more or less compressed as a consequence of the enormous development of the left testis. In fig. 2 the dorsal parts of the two testes are visible, here the left testis is seen as a wide sac, whilst of the right testis the dorsal extremity appears. In fig. 3 the widest portion of the right testis has been drawn, here the left testis has approximately the same size as in the section represented in fig 3 (the two sections are drawn on different scales!).

Towards the ventral region of the body the two testes pass into the vasa deferentia, which form short, nearly straight tubes, which are comparatively sharply limited from the testes. Originally undoubtedly the testes have been more or less globular, during the growth of the animal they have developed into the voluminous sacs with their irregular shape.

Near the central part of the lateral surfaces of the visceral mass the colleteric glands (figs. 2, 4) are found, slightly nearer to the anterior region than to the posterior part of the visceral mass. These glands are rather flat, they do not project strongly above the surfaces of the visceral mass. They contain a comparatively small number of branched tubes (a small number when compared with that in many other specimens of large size belonging to different species of the genus). In sections

through the central region of the colleteric glands (fig. 2) merely a few rather wide canals are visible in the interior of these organs. Sections through a more marginal part of the colleteric gland show a more numerous quantity of these tubes (fig. 4), as the more peripheral branches then become visible.

For the greater part the visceral mass consists of groups of eggs in the ovary. Between these groups there are visible a few muscles, chiefly running in transverse direction, whilst the whole organ is surrounded by a thin muscular layer. The mantle cavity contains a large quantity of eggs. The mantle itself possesses the usual muscle components, the sphincter of the mantle opening is well developed. As already mentioned above the posterior part of the body is highly muscular. Many of these muscles penetrate into the stalk and others surround the different parts of the male genital organs.

The thickness of the external cuticle of the mantle varies in different parts, in most regions it does not exceed  $30\mu$ . Its surface is covered with hairs which in different parts of the mantle vary slightly in shape and size (fig. 5). The length of these excrescences is  $10-20\mu$  in some regions of the mantle they are rather short and possess distinct minute lateral hairs (fig. 5a), in other parts of the mantle the excrescences are slenderer and then usually they are covered with a few minute lateral hairs only (fig. 5b). These excrescences consist of the same kind of chitin as that of which the main layers of the cuticle are composed, consequently they appear as direct protuberances of this cuticle (fig. 5c).

The retinacula of this species are variable in size and shape (fig. 6). Generally each retinaculum bears one or two spindles, but in some of these excrescences the number of spindles may be much larger, so that six spindles may be found together. The basal part of the retinacula is not developed, it consists of a more or less circular area of the internal cuticle. The spindles vary strongly in size, the smallest have a length of  $10\mu$  the largest are  $20\mu$  long. They do not bear barbs.

The retinacula are not evenly distributed on the surface of the internal cuticle, but they are arranged into narrow bands which alternate with large patches which are completely devoid of retinacula.

As far as concerns the position and the shape of the male genital organs and the structure of the external cuticle of the mantle *Sacculina gordonii* corresponds with *S. eriphiae* (first mentioned by Smith, 1906), *S. hirta* (cf. Boschma, 1933), and *S. inflata* (the parasite of *Hyas* and *Cancer*, cf. Leuckart, 1859; Anderson, 1862; Boschma 1931a). In these four species the male genital organs are found outside the visceral mass, in the

muscular region of the body to which the stalk is attached. The testes are more or less globular, at least sharply limited from the vasa deferentia, in contradistinction to those species which have cylindrical testes which pass gradually into the vasa deferentia. Moreover in the four species at least one of the testes is enormously enlarged, forming a wide sac with a thin wall, and the two testes remain separated for the whole of their extent.

Concerning the structure of the external cuticle the four species correspond in possessing similar excrescences. The latter consist of fairly long hairs which are composed of the same kind of chitin as that of the main layers of the cuticle.

*Sacculina gordonii* differs from the three other species by the arrangement of its retinacula in distinct rows on the internal cuticle. In *S. eriphiae* and in *S. hirta* the retinacula are more or less regularly distributed on the surface of the internal cuticle, whilst in *S. inflata* retinacula probably do not occur, as they could not be found in any specimen examined in this respect. Moreover the colleteric glands of *S. gordonii* differ from those of the three other species. In *S. eriphiae*, *S. hirta*, and *S. inflata* the colleteric glands are comparatively thick, more or less hemispherical, whilst in *S. gordonii* these glands form flat patches at each side of the visceral mass.

Besides *Sacculina gordonii* three other species of Sacculinidae are known as parasites of the crab *Atergatis floridus*, viz., *Sacculina weberi*, *Loxothylacus corculum*, and *Loxothylacus aristatus*. The excrescences of the external cuticle of *Sacculina weberi* (cf. Van Kampen and Boschma, 1925; Boschma, 1931b) do not differ strongly from those of *S. gordonii*. In *S. weberi* they are more loosely distributed, they are more rigid, and, especially, the little lateral hairs consist of stiff little spines. Moreover the retinacula are different in the two species, those of *S. gordonii* do not possess a basal part and their spindles are not barbed, whilst those of *S. weberi* have distinct basal parts and possess barbed spines. Anatomically the difference between the two species is still more striking: in *S. gordonii* the testes are found outside the visceral mass, in *S. weberi* these organs are embedded in the visceral mass.

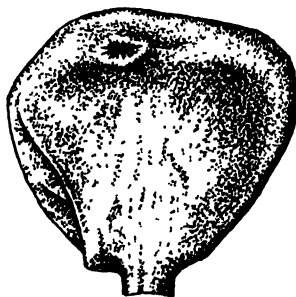
The two species of the genus *Loxothylacus* which are known as parasites of *Atergatis floridus* differ from *Sacculina gordonii* in important anatomical characteristics. Moreover the excrescences of the external cuticle have a different shape from that in *S. gordonii*. The excrescences of *L. corculum* (cf. Kossmann, 1872; Van Kampen and Boschma, 1925) consist of enormous conical spines, whilst those of *L. aristatus* (cf. Boschma, 1931b) are composed of groups of spines which are arranged on common basal parts.

It is far more difficult to identify a parasite belonging to the Sacculinidae from the Indo-malayan region than those from European waters. In the latter region from each species of crab no more than one Sacculinid parasite is known. In many cases a species of *Sacculina* or of *Drepanorhynchis* is known to infest two or more species of crabs, but these crabs never bear parasites belonging to another species of the family. In oriental waters this rule does not hold: when the host is known the parasite may belong to several species of Sacculinidae. So including the new species described in the present paper, *Atergatis floridus*, e.g., is known as a host of four different species of Sacculinidae. Many other instances of this phenomenon are known.

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Fig. 1. *Sacculina gordonii*, the surface of the parasite which was turned against the thorax of its host. At the upper part of the figure the mantle opening, at the lower part the stalk.  $\times 2$ .



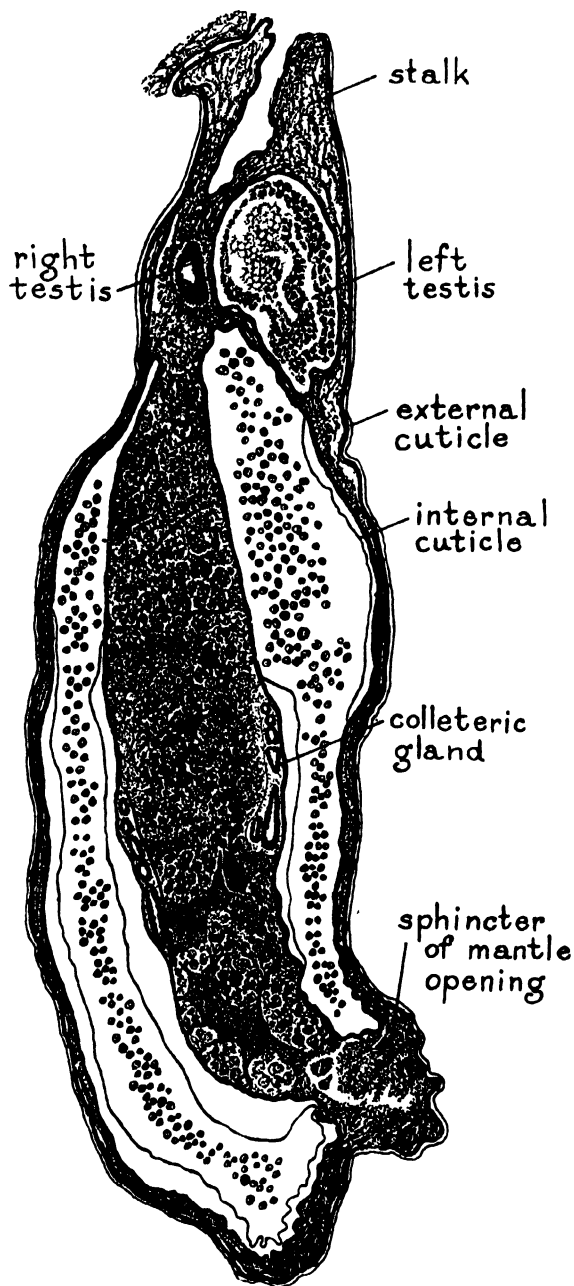


Fig. 2. *Saccolina gordoni*. Longitudinal section in the vicinity of the mantle opening.  $\times 10$ .

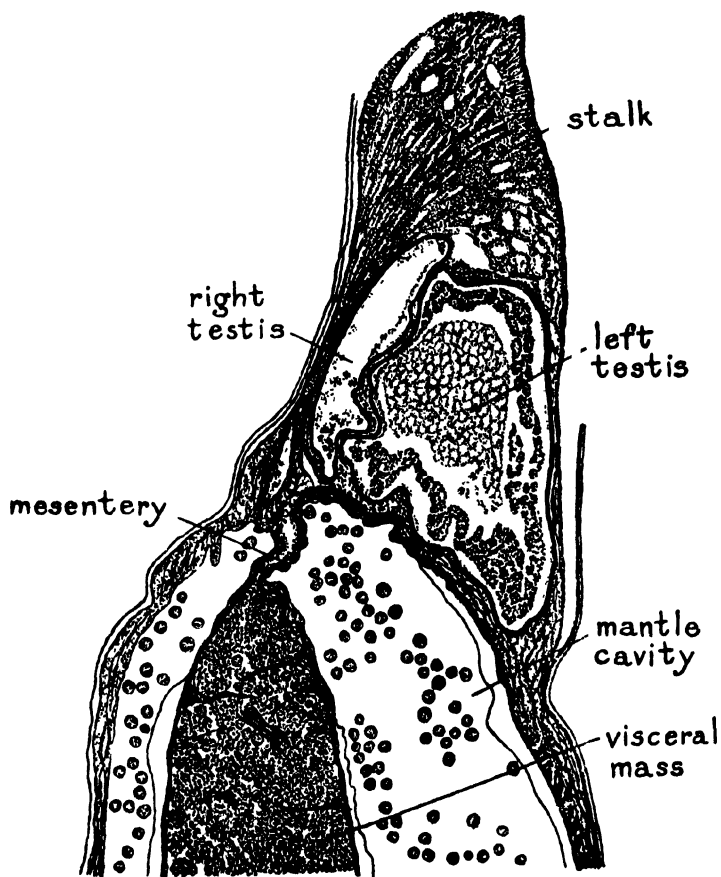


Fig. 3. *Sacculina gordonii*. Posterior part of a longitudinal section in a more ventral plane than that of fig. 2.  $\times 18$ .

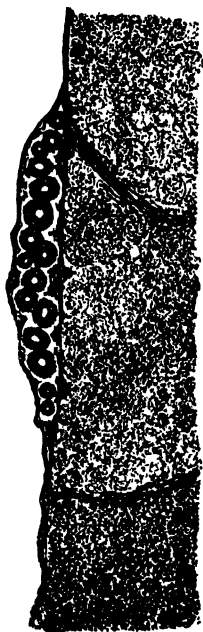


Fig. 4. *Sacculina gordonii*. Section through the colleteric gland and part of the adjoining visceral mass.  
× 36.



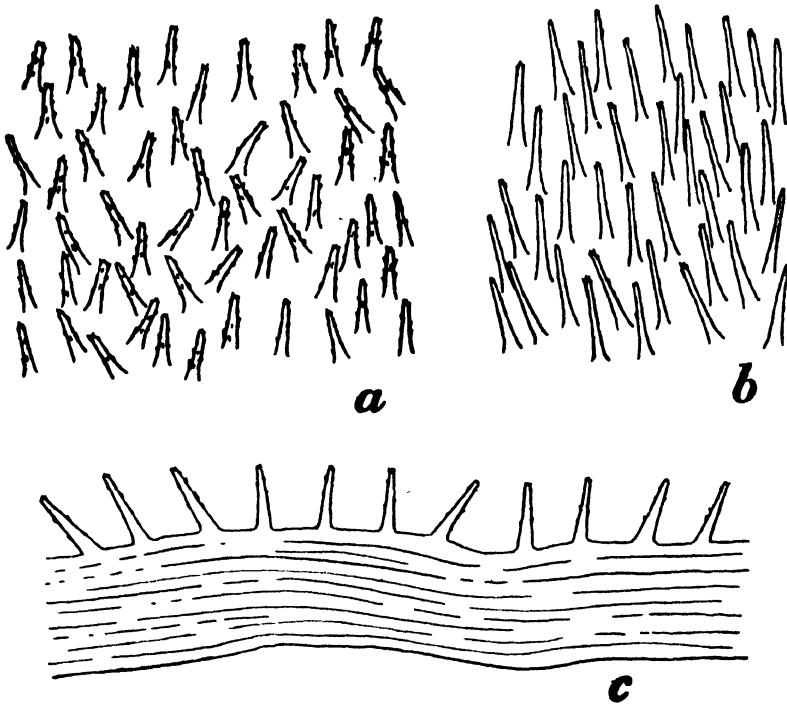


Fig. 5. *Sacculina gordonii*. *a*, excrescences as they are distributed on the external cuticle; *b*, the same on another part of this cuticle; *c*, section of the external cuticle.  $\times 530$ .

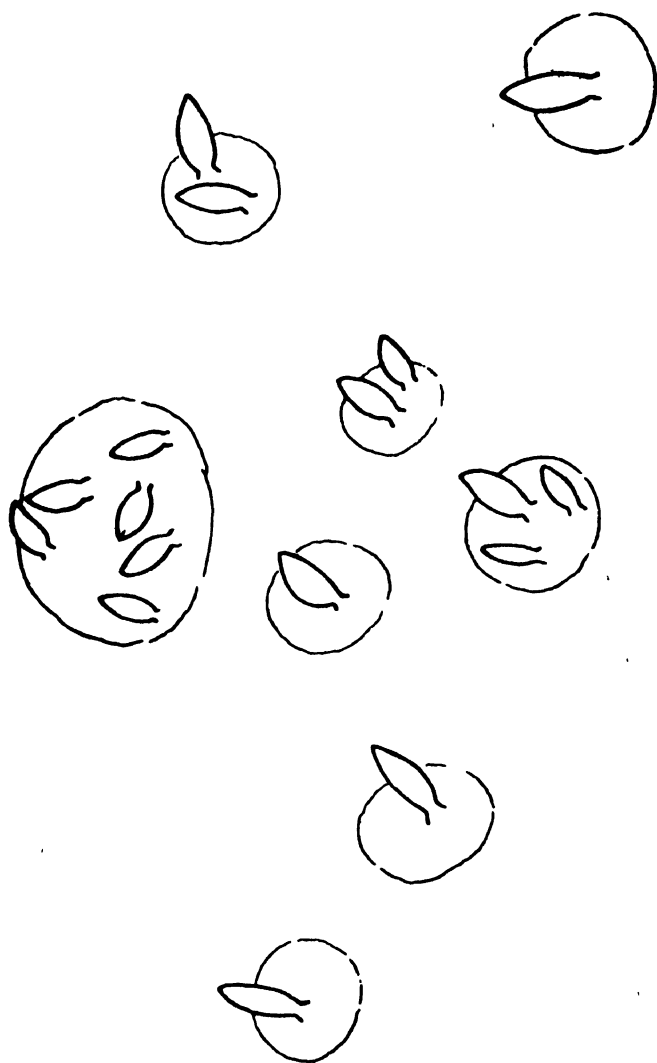


Fig. 6. *Sacculina gordonii*. Part of a band of retinacula.  $\times 530$ .

## Die Opilioniden des Mt. Kinabalu, Nord-Borneo, 13,455 ft.

von C. FR. ROEWER, BREMEN

Die Ausbeute an Opilioniden, welche mir Herr F. N. Chasen zur Bestimmung anvertraut hat, ist leider nur gering. Immerhin enthält sie eine neue Gattung der *Palpatores-Phalangidae-Gagrellinae* in zwei Arten. Im Uebrigen liegt neben einer *Laniatores*-Form noch eine Anzahl von jungen, daher nicht einmal bis zur Gattung bestimmbaren *Gagrellinae* vor.

Diese wenigen bestimmbaren Tiere sind die folgenden:

### Subord. Laniatores

#### Fam. PHALANGODIDAE

##### Sub-fam. PHALANGODINAE

***Tithaeus sarawakensis*** Rwr. — 1 ♀ — Lumu Lumu, 5,500 ft.

### Subord. Palpatores

#### Fam. PHALANGIIDAE

##### Sub-fam. GAGRELLINAE

##### Gen. *Chasenella* nov. gen.

*Gagrellinae* mit einem Mediandorn auf der 2. Area des Scutums und am 1.-4. Beinfemur 1, 5, 1, 3 Noduli (durch diese Zahl und Verteilung der Noduli von allen anderen Gattungen der *Gagrellinae* unterschieden.

#### 1. *Chasenella luma* nov. spec. (Abb. 1).

Länge des Körpers 6-6. 5, des 1.-4. Femur 8, 14, 8, 11 mm.

Tuber oculorum völlig glatt; Fläche des Carapax, des Scutums, der freien Tergite und Sternite des Abdomens gleichmässig bekörnelt; Höckerchen der Coxen-Randreihen gerade abgestutzt.—1. Glied der Cheliceren dorsal glatt.—Palpen (Abb. 1): Femur ventral, Patella rings, Tibia ventral regellos spitz bezähnt, Patella ohne Apophyse; Tarsus beim ♀ unbewehrt, beim ♂ mit zwei ventralen Körnchenlängsreihen, deren Zähnen der lateralen Reihe weiter von einander getrennt stehen und spitz sind (Abb. 1, a), während die der medialen Reihe sehr regelmässig und dicht eng bei einander stehen und gerade abgestutzt sind. (Abb. 1. b).

Färbung des Körpers und der Beine dunkelbraun, die Gelenkhäute des Körpers blass; 1.-4. Coxa mit blassem Längsstreif.—Palpen braun, nur Femur und Tarsus blass; Cheliceren einfarbig rostgelb.

*Lumu Lumu*—2 ♂, 1 ♀. (Typus).

2. *Chasenella pakka* nov. spec. (Abb. 2).

♂ — Länge des Körpers 4.5; des 1.-4. Femur 3.5, 6, 3.5, 4 mm.

des 1.-4. Beines 15, 29, 14, 19 mm.

♀ — Länge des Körpers 6, des 1.-4. Femur 4, 6.5, 3.5, 5 mm.

des 1.-4. Beines 16, 30, 16, 22 mm.

Tuber oculorum grösstenteils glatt, nur vorn-oben jederseits mit je 2-3 Zähnchen besetzt; Fläche des Carapax, des Scutums, der freien Tergite und Sternite des Abdomens, sowie der 1.-4. Coxa gleichmässig bekörnelt; Höckerchen der Coxen-Randreihen gerade abgestutzt. — 1. Glied der Cheliceren dorsal glatt. — Palpen des ♂ (Abb. 2): Femur dorsal und ventral mit wenigen verstreuten Zähnchen, Patella ohne Apophyse und unbewehrt, Tibia nur ventral mit 4-6 Zähnchen, Tarsus mit zwei ventralen Körnchenlängsreihen, deren Zähnchen der lateralen Reihe weiter von einander getrennt stehen und spitz sind (Abb. 2, a), während die der medialen Reihe sehr regelmässig und eng bei einander stehen, aber ebenfalls sehr spitz sind (Abb. 2, b).

Färbung des Körpers und der Beine braun, hell gesprenkelt, Scutum des Abdomens mit breitem, hellem Medianband. — Cheliceren und Palpen einfarbig braun.

*Pakka* (10,000 ft.) — 1 ♂, 1 ♀ (Typus).

*Kamborangah* (7,200 ft.) — 1 ♂, 1 ♀ (Cotypus, nicht ganz ausgefärbt).

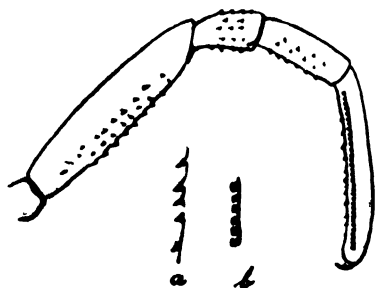


Abb. 1. *Chasenella luma* nov. spec. — ♂ — Palpus in Medialansicht; a,) einige Zähnchen der lateralen und b,) einige Zähnchen der medialen Ventralreihe des Tarsus, stärker vergrössert.

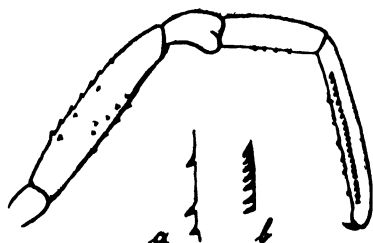


Abb. 2. *Chasenella pakka* nov. spec. — ♂ — Palpus in Medialansicht; a,) einige Zähnchen der lateralen und b,) einige Zähnchen der medialen Ventralreihe des Tarsus, stärker vergrössert.

## Opiliones aus Perak

von. C. FR. ROEWER, BREMEN

Herr M. W. F. Tweedie, Assistent Curator in Raffles Museum in Singapore, sammelte vor Kurzem einige Opiliones am River Plus im östlichen Perak in einer Meereshöhe, die 3000 Fuss nicht überschreitet. Er hat mir diese Tiere freundlicher Weise zur Bearbeitung übersandt, und ich fand in der kleinen Ausbeute beide Unterordnungen (Laniatores und Palpatores) vertreten. Auch ein paar neue Formen sind dabei. Ich führe die vorgefundenen Tiere in systematischer Reihenfolge auf.

### I. OPILIONES LANIATORES

Fam. PHALANGODIDÆ

Sub-fam. Phalangodinae

Gen. *Bupares* Thorell 1889.

#### 1. *Bupares granulatus* Thorell 1899.

Bisher war diese Art nur in 3 (♂, ♀) von Pulau Penang bekannt. Jetzt liegt sie auch vor aus:

*Perak*: Kuala Legap, Plus valley (8.3.33)—1 ♂, 3 ♀.

*Perak*: Near River Yum, Plus valley (14.3.33)—1 ♂, 2 ♀.

#### 2. *Bupares pachytarsus* nov. spec. (Abb. 1, a—c).

Körperlänge 3 mm; Länge des 1.—4. Femur 2 : 4 : 2, 5 : 3 mm; Länge des 1.—4. Beines 6 : 14 : 8 : 11 mm.

♂. Körper vorn quer abgestumpft, hinten breiter gerundet; Frontalrand des Carapax für die Cheliceren zweifach ausgebuchtet, oben glatt und unbewehrt; Tuber oculorum quer-oval, niedrig, jederseits-oben mit je einem spitzen Körnchen; Fläche des Carapax glatt; 1.—4. Area des Scutums und 1.—3. freies Tergit des Abdomens mit je einer Querreihe spärlicher Körnchen; Scutum-Seitenrand nur neben der 1. Area mit einer kurzen Körnchen-Längsreihe, sonst glatt wie der ganze Scutum-Hinterand (5. Area); 1. Area ohne mediane Längsfurche; freie Sternite des Abdomens und Fläche der 1.—4. Coxa glatt und nicht bekörnelt; Stigmen deutlich sichtbar.—Cheliceren mit glattem Dorsalbuckel des 1. Gliedes.—Pedipalen am Trochanter ventral mit 1 Stachel, Femur ventral mit 2 basalen und 1 apicalen, sowie medial-apical mit 1 Stachel, Patella medial mit 1 Stachel, Tibia ventral mit 4 medialen und 3 laterale Stacheln, Tarsus ventral jederseits mit je 3 Stacheln.—Beine normal gebaut, ihre Glieder glatt und nicht bekörnelt; der Basal abschnitt des 3 und besonders des 4. Tarsus ist auffällig verdickt (Abb. 1. b, c); Zahl der Glieder des 1.—4. 5:11:5:6; Endabschnitt des 1. und 2. Tarsus 2-gliedrig.

Färbung rostrot, Scutum jederseits schwarz genetzt, freie Tergite desgleichen. Alle Gliedmassen blassgelb.

*Perak*: Near River Yum, Plus Valley (14.3.33)—1 ♂ (Typus).

Gen. **Tweedielus** nov. gen.

Tuber oculorum nahe dem Frontalrand und vor der Mitte des Carapax gelegen, hoch aufsteigend, völlig unbewehrt und, von der Seite gesehen, stark nach vorn geneigt (Abb. 2, b).—1. Area des Scutums ohne mediane Längsfurche, 1.–5. Area und freie Tergite des Abdomens völlig unbewehrt und ohne Dornpaare;—4. Coxa viel breiter als die übrigen; Stigmen deutlich sichtbar.—Cheliceren kräftig, ihr 1. Glied mit deutlich abgesetztem Dorsalbuckel.—Palpen kräftig; Femur so dick wie die übrigen Glieder und medial-apical mit 1 Stachel bewehrt; alle Palpenglieder bestachelt. Beine: Endabschnitt des 1. und 2. Tarsus jeweils 2-gliedrig; Zahl der Glieder des 1.–4. Tarsus 5, mehr als 6, 5, 6.

*Perak*: 1 Art.

3. **Tweedielus longipes** nov. spec. (Abb. 2, a–d).

Körper in Dorsalansicht im Umriss siehe Abb. 2, a; 1.–4. Area des Scutums, Seitenrand des Scutums, freie Tergite und Sternite des Abdomens und 1.–4. Coxa glatt und nicht bekörnelt, auch die Cheliceren glatt.—Pedipalpen: Trochanter mit 2 ventralen, Femur mit 3 ventralen und 1 medial-apicalen, Patella mit 1 medialen Stacheln, die hier auffällig kurz und kugelförmig sind; Tibia und Tarsus verbreitert, die Stacheln auch hier stumpf und dick, ihre Basis etwas gegen das Glied abgeschnürt, doch viel stärker und grösser als an den basalen Gliedern, Tibia ventral mit 2 medialen und 3 lateralen, Tarsus ventral jederseits mit je 3 solcher dicken Stacheln (Abb. 2, c, d).—1.–4. Bein an allen Gliedern glatt und nicht bekörnelt; Zahl der Glieder des 1.–4. Tarsus 5:10:5:6.

Färbung des Körpers und sämtlicher Extremitäten einförmig rostgelb.

*Perak*: Near River Yum, Plus Valley, (14.3.33)—1 ♂, 1 ♀ (Typus).

*Perak*: Kuala Legap, Plus Valley (8.3.33)—3 ♂, 4 ♀.

Sub-fam. **Sarasinicinae** Roewer.

Gen. **Siponnius** Roewer 1927.

4. **Siponnius stimulatus** Roewer 1927.

Bisher war diese Art nur in 1 ♂ bekannt von Pulu Pinang. Jetzt liegen mehrere ♂ und ♀ vor aus:

*Perak*: Near River Pum, Plus Valley (14.3.33)—2 ♂, 1 ♀.

*Perak*: Kuala Legap, Plus Valley (8.3.33)—1 ♂, 1 ♀.

II. Subord. **OPILIONES PALPATOIRES**

Fam. **PHALANGIIDÆ**

Sub-fam. **Gagrellinae**

Gen. **Dentobunus** Roewer 1910.

5. **Dentobunus acuarius** (Thorell 1891, sub **Gagrella**).

*Perak*: Kuala Legap, Plus Valley (8.3.33)—1 ♂.

Gen. **Hologagrella** Roewer 1910.

6. **Hologagrella reticulata** Roewer 1910.

Bisher nur in 1 ♂ bekannt.

*Perak*: Near River Yum, Plus Valley (14.3.33)—1 ♂, 2 ♀.

Gen. **Gagrella** Thorell

7. **Gagrella atrorubra** Simon 1901.

*Peruk*: Kuala Legap, Plus Valley (4.-9.3.33)—3 ♂, 4 ♀.

8. **Gagrella biseriata** Simon 1901.

*Perak*: Kuala Legap, Plus Valley (4.-6.3.33)—6 ♂, 11 ♀.

*Perak*: Near River Yum, Plus Valley (14.3.33)—2 ♀.

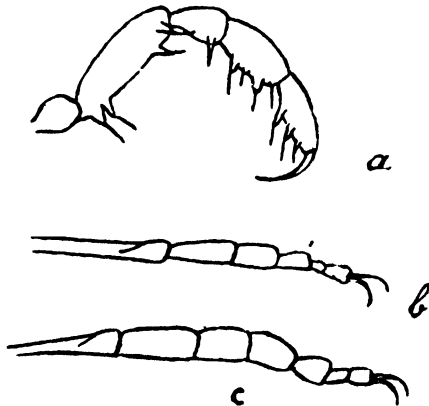


Fig. 1. *Bupares pachytarsus* n. sp. a=linker Pedipalpus medial, b=3. Tarsus mit verdicktem Basal abschnitt, c=4. Tarsus, desgleichen.

## INTRODUCTION

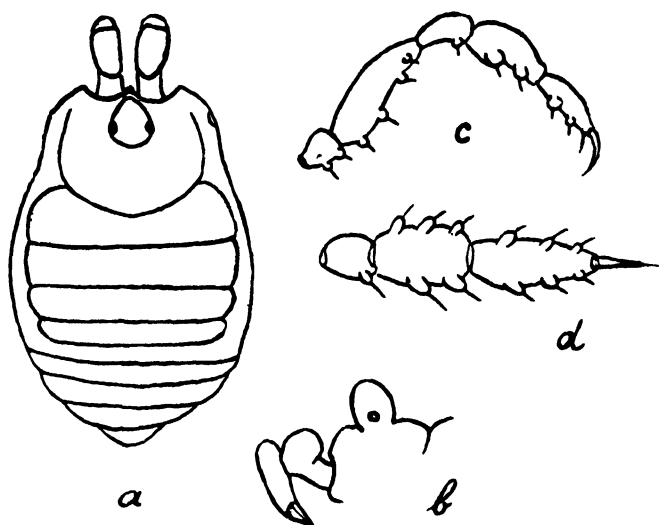


Fig. 2. *Tweedielus longipes* n. sp. *a*=Körper mit Cheliceren in Dorsalansicht, *b*=Carapax mit Cheliceren und Tuber oculorum in linker Seitenansicht, *c*=linker Pedipalpus medial, *d*=Patella bis Tarsus des rechten Pedipalpus in Ventralansicht.

## Notes on the Fauna of Christmas Island, Indian Ocean

### INTRODUCTION

By F. N. CHASEN

Christmas Island is about 190 miles from the south coast of Java, nearly three times that distance from the Cocos Keeling Islands to the west and roughly 900 miles from the Australian coast to the east. Between it and Java are depths of over 3,000 fathoms.

The fauna includes a high percentage of peculiar forms. All the indigenous birds and mammals are well differentiated; the resident birds are of Austro-Oriental rather than Malaysian affinities. The island constantly receives additions to its biota both by natural means and by human agency. Winds from the



north in the first third of the year bring vagrant birds, butterflies and moths: large numbers of dragonflies also appear at such times but soon disappear.

Several collectors preceded the late C. W. Andrews on Christmas Island but his "Monograph" published in 1900 and aptly described at the time as the best account of a true oceanic island that had ever been published, summarized the results of their work and gave in addition detailed accounts of his own extensive collections. Andrews' book was restricted to descriptions of the geology and physical features with the land fauna and flora, but further reports including some dealing with the littoral fauna were published subsequent to the monograph and to the author's second visit to the island in 1908.

Another zoologist, Dr. R. Hanitsch of the Raffles Museum worked on Christmas Island in 1904 but no general account of the collections made has been published. A short paper on two fresh water crustaceans from the pen of the late Dr. J. G. de Man appeared in 1905 and in various publications there are casual references to a number of the species obtained but these are now difficult to trace.

A small collection of vertebrates was made by two Dayak collectors attached to the Malayan Museums in 1923: a short paper on the birds obtained was published.

In 1887 the island was uninhabited although it had been visited before that date. It was annexed by the British Government in 1888 and a settlement was established. Soon after a company was formed for the purpose of exploiting the rich phosphate deposits and large numbers of coolies were imported. Changes in the fauna were therefore to be expected for a number of species were certain to be introduced by other than natural means. Andrews, for instance, mentions large centipedes (*Scolopendra*) arriving in coco-nut leaves imported for thatching. Faunal changes in such an isolated locality as Christmas Island are of particular interest to the zoologist.

After his return visit to the island in 1908 Andrews recorded that such changes had already taken place chiefly in the neighbourhood of the settlement and quarries. Neither of the indigenous rats nor the shrew could be found. *Rattus rattus* was present on the island<sup>1</sup> and perhaps had brought with it an epidemic disease responsible for the disappearance of *Rattus macleari* and *R. nativitatis*. The native land-birds had held their own and no introduced bird had obtained a footing on the island. No changes of importance were noticed among the native invertebrates although the *Scolopendra* had increased in numbers.

1. *Mus musculus* and *Rattus concolor* were also collected on the island in 1932.

## INTRODUCTION

Probably many insects had been introduced but nothing definite was said on this point.

Hanitsch obtained a starling, *Aethiopsar grandis javanicus* (Cab.) in 1904. In 1923 a mynah *Gracula javana* (Cuv.) and the Java Sparrow, *Munia oryzivora* (Linn.) were obtained: all are common cage-birds in native villages throughout Malaysia.

The present short papers are the result of a visit to the island made by Mr. M. W. F. Tweedie of the Raffles Museum in 1932 (20th August–25th September) primarily for the purpose of conducting an investigation into the status of the indigenous fruit-pigeon, *Ducula whartoni*, at the request of the Government of the Straits Settlements.

The opportunity was taken of making small collections of various animals. Some specialists have been kind enough to examine and report on these and the first results are given below. They are fragmentary, but as they supplement in a small way our knowledge of the changing fauna of this interesting island they seem worth publishing. For instance, Andrews' long stay on the island produced nine species of *Rhopalocera* of which two, perhaps owing to the luck of collecting, are not represented in the 1932 collection, but on the other hand Mr. Tweedie's casual collecting has, according to Mr. Pendlebury, added no less than four species to the island fauna, a noteworthy result.

## LITERATURE

The following can be added to the list of papers relating to Christmas Island given by Andrews (p. 318).—

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- 1926. NUTTAL, W. L. F.—“A Revision of the Orbitoides of Christmas Island.” Quart. Journ. Geol. Soc., 82, 1926, pp. 22–42; pls. iv–v.

## A Note on the Topography of Christmas Island, Indian Ocean

By M. W. F. TWEEDIE, M.A.

(Plates I, II.)

Almost the whole of the coast of the island is formed by steep, but usually not very high, limestone cliffs at the base of which is a fringing coral reef of varying width, outside which the submarine slope descends steeply to a depth of over 2,000 fathoms. At infrequent intervals there are embayments or coves, the largest being Flying Fish Cove where the main settlement is situated.

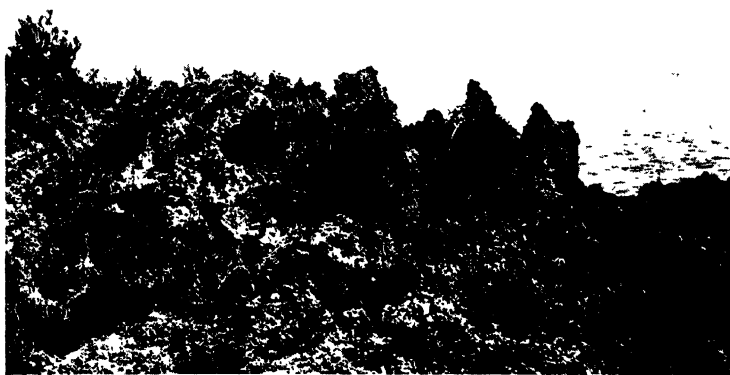
Plate I, upper figure, shows a small cove of this nature with part of the fringing reef exposed.

Above the sea cliffs there is a terrace of varying width which forms a very constant feature, almost completely surrounding the island. Near the outer edge there is usually no soil, but only deeply fissured limestone, weathered into jagged pinnacles, and the vegetation is low and sparse. This type of scenery is shown in the lower figure on Plate I. The inner part of the shore terrace is in places rocky and deeply fissured, but is mostly covered by soil and occupied by large trees which harbour the nests of gannets and frigate birds.

The shore terrace is bounded on the landward side by another steep cliff, above which are other rather ill-defined cliffs and terraces surmounted by the plateau which forms the greater part of the area of the island. This is completely covered by jungle, two photographs of which are reproduced on Plate II. On the plateau there are several hills, the highest of which, Murray Hill, rises to a height of about 1,170 feet. The steeper slopes of these hills are covered with boulders and deeply fissured outcrops of limestone.



*Coral reef exposed at low tide.*



*Limestone pinnacles on the shore terrace.*

CHRISTMAS ISLAND, INDIAN OCEAN.





*Jungle on the plateau*



## Notes on the Birds of Christmas Island, Indian Ocean

By F. N. CHASEN

Stimulated by a collection of skins of the now well-known birds of Christmas Island in the Indian Ocean made by Mr. M. W. F. Tweedie in 1932 I have been led to re-examine all the material from the island in the collection of the Raffles Museum, to discuss certain points in the affinities and life-histories of some species and, although the available information is very scanty, especially to enquire into the distribution in Malaysia of the sea-birds between the breeding seasons, as I have for some time appreciated the fact that some are not so evenly distributed over the local seas and coasts as might, from a study of their breeding places and habits, be reasonably expected. For instance, the gannet *Sula sula rubripes* has not been recorded from the Straits of Malacca, and the Noddy, *Anous stolidus*, also shuns the Malayan coasts: *Sterna fuliginosa* breeds in the Keeling Atollon but is unrecorded even as a visitor to Christmas Island!

With regard to the subject of nidification it is worth noticing the climate of the island. Most of the year is taken up by the so-called dry-season and from May to December the pleasant south-east trade is the prevailing wind. In the early months of the year the wind may shift round to the north and north-east increasing in strength and bringing rain; most of the annual rainfall occurs from December to May.

Little is known of the breeding habits of most of the birds on Christmas Island and nothing at all of some, but it seems just possible to glimpse certain broad principles concerning the seasons. During the five months from March to July there is little activity. December and January are favourite months for egg laying. The unsettled, rather wetter and windier months of the year are therefore those in which the majority of the young birds are reared. *Ducula*, *Chalcophaps*, *Accipiter*, *Phaëthon* and *Sula sula* all breed in December and January. There is a suggestion of a secondary peak of egg-laying (*Phaëthon* and *Sula leucogaster*) in August and September.

All the indigenous land birds of the island seem to be holding their own.

Although in some cases lack of material is still a handicap it is now possible, owing to the discovery of many new forms in the Lesser Sunda Islands, to discuss the affinities of the indigenous land-birds of Christmas Island in greater detail and more accurately than was possible nearly fifty years ago when it was



thought that the nearest allies of the thrush were in west Africa, China and Fiji; of the fruit-pigeon in Japan and the Pacific; and of the white-eye in New Guinea.

The seven indigenous land-birds of Christmas Island (*Ducula rosacea whartoni*, *Chalcophaps indica natalis*, *Accipiter fasciatus natalis*, *Ninox forbesi natalis*, *Collocalia esculenta natalis*, *Turdus javanicus erythropleurus* and *Zosterops natalis*) are well marked subspecies at once separable from the nearest comparable race. In appearance *Ducula* and *Zosterops* are the most distinctive or isolated: on colour the former is so distinct that it can only be linked to its "parent-form" on morphological characters: the *Zosterops* also is so distinct from any other known form that determination of its relations is largely a matter of guesswork.

The *Collocalia* is perhaps the least differentiated of the island forms, but the dull cave-dwelling swiftlets are usually constant in major colour characters over wide geographic ranges.

Of the seven species apparently represented by the indigenous subspecies four (*Ducula rosacea*,<sup>1</sup> *Accipiter fasciatus*, *Ninox forbesi* and *Zosterops citrinella*) are mainly or in a large part Austro-Oriental<sup>2</sup> in distribution and are not found in Malaysia.

Three species (*Chalcophaps*, *Collocalia* and *Turdus*) are of wider distribution and are found in Malaysia also. Of these we find that in the cases of *Turdus* and *Collocalia* the Christmas Island forms are much nearer in appearance to certain Austro-Oriental than to any Malaysian sub-species: on the balance of characters the *Chalcophaps* also belongs to the Austro-Oriental sub-region.

It can therefore be fairly stated that the indigenous avifauna of Christmas Island is Austro-Oriental<sup>3</sup> in its present affinities which is surprising when the nearness of Java is considered.

In more detail we find that of the Austro-Oriental sub-species the Christmas Island races are most like those found in the chain of islands stretching from Sumbawa to Timor Laut and, furthermore, when, within this limited area, subspecific distinctions can be recognised in a species, the Christmas Island form is more like that found in Sumba, Savu, Timor etc., than that inhabiting the more western Sumbawa and Flores.

1. I have ignored the minor infiltration of *Ducula rosacea* along the tiny islands in the Java Sea.

2. Some may enter the Papuan and Australian sub-regions. Austro-Oriental and similar terms are here used in the sense described and illustrated in detail in Bull. Raffles Museum, 2, 1929, pp. 1-9.

3. In 1888, Lister wrote, "It appears probable that Christmas Island received immigrants from both the Indo-Malay and Austro-Malay sub-regions; but so far as the birds are concerned, the influence of the latter is much more distinctly marked".

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In addition to the resident birds mentioned above a number of alien species are recorded from the island. These non-resident birds can be divided into five groups.

1. *Species obviously introduced as cage-birds.* These are *Aethiopsar grandis javanicus* (1904); *Gracula r. religiosa* (1923); and *Munia oryzivora* (1923). In 1932 no trace of the first two could be found: they have not established themselves on the island. The *Munia* no doubt receives frequent additions to its numbers.

2. *The migratory waders.* These breed far away in the north and although there is a paucity of records from the island chain between Lombok and Timor Laut the birds are too widely spread in their winter quarters to be of much use in a discussion on faunal affinities or even to throw any light on the routes followed by birds travelling to the island. In the presence of the Sanderling (*Crocethia*) there is a faint suggestion that the migrants arrive from the east rather than from the west, for during migration this wader, although common on the China coast seems to be rare in French Indo-China, Burma and Eastern India and it has yet to be recorded from Siam, the Malay Peninsula and Sumatra. On the other hand, a few specimens are recorded from the Philippines, Borneo and Java.

3. *Other birds probably regular migrants.* *Chalcites basalis*, *Hirundo rustica gutturalis* and *Motacilla cinerea caspica* are widely spread in their winter quarters. The immature wagtails recorded by Sharpe as *M. flava* are probably *M. f. simillima* but in view of recent work they require re-examination. Long-winged migratory races of *Butorides striatus* from the north are now known to occur in winter from the Malaya Peninsula east to Celebes. Either *B. s. amurensis* or *B. s. connectens* is therefore almost certain to turn up in the Lesser Sunda Islands.

4. *Wanderers.*—These are not long-ranging migrants but species resident in Malaysia and the Austro-Oriental sub-region, given to wandering or to local movements. Such are *Limnobaenus fuscus* (the typical race fide H. C. Robinson in litt.), *Myristicivora bicolor* and *Anas gibberfrons*. *Demigretta sacra* probably belongs to this section but it may be a resident.

5. *Accidental visitors.*—The only possible record of a true, non-migratory land-bird arriving on the island is that of the *Anthus* identified and recorded by Mr. Kloss and myself in 1924 as *Anthus richardi malayensis* but I am now a little doubtful of the identification. With the wing and tail measuring 88 and 68.5 mm. respectively this specimen is large for *malayensis*.

There is geological evidence for supposing that Christmas Island was formerly an atoll, now elevated and exposed as the

top of a mountain, mostly submerged, but rising over 15,000 feet above the bed of the sea.

Unless, therefore, we suppose that its birds are relics of an avifauna now almost extinct in Malaysia it must be assumed that the island was colonized from the Lesser Sunda Islands and that as the question of a former land connection need not be considered, attention must be turned to the main physical conditions likely to be influential: these are the winds from the north and north-east of the first quarter of the year; the less strong south-east trade which blows almost unceasingly for ten months in the year; and the equatorial drift flowing down from the north-east.

The winds from the north are now only known to bring migrants and birds of a wandering disposition to the island and Andrews, recognizing the "Austro-Malayan" element among the birds therefore suggested former different meteorological conditions to account for the wind-aided arrival of land birds.

Regarding the ocean current, Wood-Jones has shown that floating objects brought to the Cocos-Keeling Islands, hundreds of miles west of Christmas Island, are carried from the east by currents that wash the shores of north Australia and of the Lesser Sunda Islands. Pumice from the Krakatua eruption of 1883 is common on the beaches and further inland than the present sea-beaches there is older, less clean pumice, most probably of the great Sumbawa eruption of 1815.

***Ducula rosacea whartoni* (Sharpe).**

*Carpophaga whartoni* Sharpe, P. Z. S., 1887, p. 515, pl. xliii (Christmas Island, Indian Ocean); Mon. Christ. Island, 1900, p. 37.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from front edge of feathers	Tarsus
♂	453	186	271	..	21	39
♂	449	172	254	34	20	37
♂	457	181	269	..	22	37
♂	457	186	270	..	20	38
♂	..	183	..	..	18	..
♂	..	180	260	..	20	38
♂	453	189	273	..	20	37
♂	488	186	271	..	20	38
♀	..	172	..	..	20	..
♀	457	187	267	..	20	37
♀	436	175	258	34	21	38

"Irides, bright yellow; bill, slaty black or black; feet, dull crimson" (*male and female*).

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"Bill, greenish black" (*female*).

"Iris, yellowish brown; bill, greenish black; feet, reddish brown" (*immature*).

The feet of the immature bird have been described as "grey" in colour which is rather different from Mr. Tweedie's "reddish brown".

*D. r. whartoni* is a much darker and more bronzy bird than the figure in my copy of Proc. Zool. Soc., 1887, pl. xliii shows, and the prevailing tone of the under parts is deep cherry-purple rather than blue. Furthermore, Salvadori's description in Cat. Birds XXI, p. 184 is much better than Sharpe's original description which was drawn up from a bird sent home in alcohol.

The sexes are exactly alike in colour.

In immature plumage *D. r. whartoni* has the head and neck rather paler and less glossy than the adult; the upper parts much less metallic; the vinous wash of the under parts replaced by a dull earthy brown; and the outer under wing coverts and edge of the wing mottled with rich buff.

In considering the affinities of this fruit-pigeon, which is a very distinct and dark form, two closely allied species must be noticed. Firstly, the geographically nearest *D. aenea*, widely spread in the Malaysian sub-region but only entering the Austro-Oriental sub-region at the south-western corner by the chain of islands stretching east from Java, along which it is found as far east as Alor; and secondly, *D. rosacea*, found in the west of the Papuan and throughout the Austro-Oriental sub-region but only entering Malaysia by way of a few small islands in the Java Sea<sup>1</sup> (west to the Karimon-Java Islands). From Sumbawa east to Alor *aenea* and *rosacea* are found together. Superficially the two species are much alike. In colour the differences are merely quantitative: *rosacea* is less green on the upper parts and more washed with vinous on the head and under parts; its chestnut under tail coverts lack the characteristic maroon tone seen in *aenea*. In structure, however, there are more decisive differences. In *aenea* the bill is large with small, oblique nostrils and the space between the nostrils and the edge of the frontal feathers is greater: in *rosacea* the bill is small with large, forwardly directed nostrils the space between nostrils and feathers being lesser. The tarsus is more feathered in *rosacea* than in *aenea* which fact can best be appreciated by noting the space between the tarsal feathers and the base of the hind toe. In all these structural characters *whartoni* agrees entirely with *rosacea*. In colour it is so much darker than any

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1. Unless the little known *D. vandepolli* of Nias Island, west coast of Sumatra, is also a subspecies.

allied form that comparison is difficult but it may be noted that the under tail coverts of *whartoni* are the chestnut of *rosacea* rather than the maroon of *aenea* and that in the deep vinous wash of the under parts it is also nearer to the former species. A specimen of *whartoni* badly faded by long exposure in an exhibition gallery is much more like *rosacea* than are fresh skins.

Beyond the scanty notes of Andrews published in 1900 nothing is known of the nidification of this bird.

The present collection contains a young bird of the year with the outer primaries and rectrices still in sheath at the base, dated 25th August. Some full grown immature birds are dated 1st October 1904. Andrews mentions an egg on 6th January and young birds in April and November. The breeding season is therefore a long one and the bird may well be double brooded.

The status and protection of the Christmas Island Fruit Pigeon have been subjects of consideration by the Government of the Straits Settlements on numerous occasions since 1904 but opinion on the necessity for protection has never been unanimous.

It has been stated that the bird is an essential article of food to the people living on the island but in spite of present local opinion it is difficult to see why the islanders should be in any way dependent on the pigeons for there is now an abundance of animal food on the island and a cold-storage plant.

*D. r. whartoni* was discovered in January 1887 by Capt. J. P. Maclear of H.M.S. "Flying Fish". In September of the same year J. J. Lister visited the island in H.M.S. "Egeria" and described the bird as "very abundant". It was recorded as "plentiful" and "not uncommon" near the *settlement* as late as 1898 but in 1904 the District Officer became anxious about the bird and Dr. R. Hanitsch of the Raffles Museum was sent to the island to make a detailed investigation and report.

Dr. Hanitsch stated that he found the pigeon common everywhere on the plateau but not at all on the shore terrace, that is, that part of the island above the sea-cliff and below the inland cliff bounding the plateau; also, that it had disappeared from Flying Fish Cove, that is, the neighbourhood of the settlement, since Andrews' visit. The opinion of both Europeans and natives was that the species had greatly decreased in numbers during the previous few years but Dr. Hanitsch observed that there were still large numbers of pigeons on the island.

In 1929 it was reported that the bird was "rapidly dying out" but local opinion was divided.

In 1932 Mr. M. W. F. Tweedie of the Raffles Museum was sent to the island to make a further report on the status of the

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bird. From a very careful study of Dr. R. Hanitsch's report and from all the local and visual evidence gained during his own visit Mr. Tweedie concluded that the bird was less common than in 1904, but also that it was in no immediate danger of extermination, nor had its numbers been depleted so seriously as to cause alarm.

The history of the protecting legislation starts, officially, in 1904 when the months of January to April were declared a close season, but the Government's action had been anticipated, to some extent, by the Phosphate Company which licensed the professional bird-catchers and issued certain instructions to stop indiscriminate capture and sale and also prohibited the export of the birds.

Total protection was given in 1930, 1931 and 1932 but in spite of this the situation was not satisfactory. One great difficulty was that it was manifestly impossible for the District Officer to enforce protection with the police force at his disposal. Furthermore, the measure of total protection seems to have alienated the sympathy of the non-official Europeans resident on the island. In 1933 the system of permanent legal protection was abandoned and a return made to the old system of a close season from January to April with a system of licensing the catchers and regulation of the number of birds each catcher was allowed to take in the open season.

### ***Chalcophaps indica natalis* Lister.**

*Chalcophaps natalis* Lister, P. Z. S., 1888, p. 522 (Christmas Island, Indian Ocean); Sharpe, Mon. Christ. Island, 1900, p. 39.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen	Tarsus
♂	244	86	144	22	15	27
♂	240	83	141	21	15	26
♂	233	85	141	19	15	27
♂	245	81	142	23	15	27
♂	244	85	..	..	16	26
♂	260	82	142	..	15	26
♀	234	82	133	22	16	25
♀	245	..	135	..	17	25
♀	241	79	138	21	15	26
♀	250	82	138	..	16	26

"Irides, dark brown; bill, orange-red, purplish at base; feet, purplish red" (male).

"Irides, dark brown; bill, reddish brown, purplish red at base; feet, purplish red" (female).

The wings of some *natalis* measured by Robinson (manuscript) are ♂ 134, 134, 142, 143; ♀ 131, 133, 135, 135 mm. For the subspecies then, males give a wing-range of 134-144 mm.; females running very slightly smaller, 131-138 mm.

*C. i. indica* overlaps *natalis* in size but averages larger, many examples being over the maximum of *natalis*. On the other hand in almost all cases the bill of *natalis* is markedly more robust than in *indica*.

Salvadori has stated that adult males of *natalis* and some males of *indica* are indistinguishable which seems curious as the females of the two forms are so different. I have therefore made a close comparison of six males of *natalis* and about fifty adult males of *indica*, which latter form seems absolutely inseparable throughout Malaysia excluding Christmas Island. The difference in the bills of *natalis* and *indica* has already been mentioned above and I find that there are also colour distinctions.—

1. *Natalis* average less blue on the hind neck but the character is not decisive.

2. It is washed with chestnut on the abdomen and flanks: only one *indica* (from Siam) could be confused.

3. The bluish white marks on the shoulder are almost invariably smaller as Lister affirmed and Salvadori denied.

4. Most important of all, males show a hitherto overlooked tendency to erythrism, for they have some of the primaries very narrowly edged on the outer web with rufous, and the brown tail feathers tinged with the same colour especially on the outer webs at the base. I have seen a few Malaysian *indica* with indication of a rufous edging to the primaries but none with rufous in the tail.

In females the differences between *natalis* and *indica* are more marked, the tendency to erythrism in the female of *natalis* being very pronounced: it therefore seems to approach *timorensis* which I have not seen.

Four females of *natalis* differ from a long series of the same sex of *indica* in having no indication of the whitish blue forehead and supercilium; the head, neck, mantle and under parts purer chestnut; the under tail coverts largely chestnut instead of blackish tinged with chestnut; and in having the pale bands across the lower back brownish buff instead of whitish blue. The lower rump and upper tail coverts are bright chestnut, a few of the tail coverts being usually indistinctly bordered with blackish: in extreme cases *indica* has these parts dull brownish chestnut but they are much more often largely blackish. The tail of female *natalis* is bright chestnut except the outermost pair of feathers which are pale blue: a few of the outer pairs of feathers have broad subterminal black bands. In *indica* the

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outermost feathers are blue and the chestnut of the remaining feathers is much duller: the centre pair of feathers is often brownish black.

On its male *natalis* is therefore most like the form of *indica* which is found along the island chain as far east as Sumba and Alor: on description, the female of *natalis* seems nearest to that of *timorensis* which is found in Timor, Wetar and some other small island-groups further east.

Nothing definite is known of the breeding habits: Andrews mentions young birds being seen in April. My August birds are in fresh plumage or near the end of a complete moult: November specimens in worn plumage are starting to drop the inner primaries!

## *Anous stolidus pileatus* (Scop.)

*Sterna pileata* Scopoli, Del. Flor. Faun. Insubr., 2, 1786, p. 92 (Philippine Islands).

*Anous stolidus*, Andrews, Mon. Christ. Island, 1900, p. 39.

Adults of this race in the Raffles Museum give the following measurements.—

Locality	Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen	Tarsus
Islet off coast S. E. Siam ..	♂	432 <i>W.J.W.</i>	160	288	..	40	26
North Natuna Islands ..	♂	..	140	..	53	39	23
Straits of Malacca ..	♂	413	158	274	..	39	24
Barren Island, near Tambelan Islands	♀	..	156	274	..	39	23
Do.	♀	..	160	280	..	42	26
Christmas Island ..	♂	420	153	279	59	42	25
Do.	♂	439	160	284	58	43	25
Do.	♀	421	161	282	..	39	24
Do.	♀	417	160	273	..	40	25
Do.	♀	434	169	283	..	39	24

"Irides, dark brown; bill, black; feet, dark purplish brown".

Christmas Island birds dated 24th August include cleanly moulted adults in fine breeding plumage with a grey bloom on the mantle, immature birds of doubtful status and full grown birds of the year with the outer primaries still in sheath at the base. A nestling in down was seen on 15th September. Birds collected on the island at the beginning of November are in faded, worn plumage and dropping their primaries.



From the Paracel Islands in the China Sea off the coast of Annam, Delacour and Jabouille record many nests with young at the beginning of July<sup>1</sup>. On a bare low-lying rock a few miles south of Koh Chuan in the inner Gulf of Siam, Williamson found eggs, each laid singly in a slight depression on the bare rock on 9th May<sup>2</sup>. Kloss and Abbott<sup>3</sup> discovered numbers of nestlings on the Rocky Islets in the Tambelan group on 14th August, but the birds had practically finished breeding, and on Barren Island, a few miles to the northwest, Moulton found plenty of eggs on 25th June. Dates for eggs from Christmas Island are lacking. Wood-Jones<sup>4</sup> states that in the Keeling Atoll the breeding-season has almost come to an end in June: in these islands the south-east trade also prevails for the greater part of the year, the weather being unsettled from December to February when the wind is likely to vary. April is said to be the wettest month. The breeding habits of the Noddy are as variable in Malaysia as elsewhere. Sometimes, as in the Keeling Atoll, it makes a nest: at other times the egg is placed on the bare rock. As in other parts of its range, the Noddy is, in Malaysia, a bird of the open sea, not commonly approaching the coasts. It is recorded that Davison saw numbers of this tern when passing backwards and forwards through the Mergui Archipelago but in the Straits of Malacca it is extremely rare although Mr. E. Seimund met with a number and shot one at Pulau Jarak in November 1919. From the east coast of the Peninsula and the Tioman Archipelago it is unrecorded but ornithologically we know little of these localities during the north-east monsoon. In the South China Sea there are records from the Anamba and Natuna Islands from September to November. On the coast of Sarawak it is rare but it sometimes appears during the north-east monsoon. From the Java Sea I have seen a skin from the Karimon-Java Islands where perhaps it breeds. Of its occurrence near the coasts of Sumatra and Java nothing certain is known but it is recorded from Nias Island off the west coast of Sumatra. It could be expected to occur regularly along the south coast of Java but of this island Bartels has written "Sichere Belegstücke sind uns nicht bekannt".

***Sula sula rubripes* Gould.**

*Sula sula rubripes* Gould, Syn. Bds. Austr., pt. 4, 1838, app., p. 7 (Australia).

1. Travaux du Service Océanographique des Pêches de l'Indo-chine, 3, 1930, p. 14.

2. Journ. Nat. Hist. Soc. Siam, 3, 1918, p. 38.

3. Kloss, Journ. Straits Br. Roy. Asiat. Soc., 40, 1904, p. 66 and Oberholser, Proc. U. S. Nat. Mus., 55, 1919, p. 136.

4. P. Z. S., 1909, p. 137.

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*Sula piscatrix*, Andrews, Mon. Christ. Island, 1900, p. 45.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from feathers	Tarsus
♂	719	208	387	105	86	35
♂	675	192	389	102	89	34
♂	690	206	390	99	83	34
♂	697	194	..	105	84	35
♂	700	180+	389	..	84	33
♂	685	204	376	102	84	32
♀	701	207	376	105	86	34
♀	695	193	373	..	89	34
♀	726	201	392	..	91	35

"Iris, light greenish brown, grey, or pale putty colour; bill, dark grey or blackish, interramal skin and orbital skin, blue-grey or dull blue and brown; feet, pale yellowish or greenish pink (*immature in brown plumage*).

"Iris, grey" (*birds in mottled plumage*).

"Iris, very dark brown; bill, pale blue or light greenish blue, naked skin round gape and base of mandible, pinkish; interramal skin, dull purple; eyelids, dull blue, the lower one paler; feet, bright rose-red" (*adults of both sexes*).

There is still much difference of opinion concerning the colour of the soft parts in this common bird and published observations vary greatly even they refer to specimens which on geographic grounds should all belong to *rubripes* if that race is really separable. It was fairly well agreed that in adults the iris is pale, that is from grey to yellow in colour but Mr. Tweedie has now complicated matters by recording the irides of all his adults as "very dark brown"!

A point of considerable interest is that young birds of this species still retaining filaments of down are actually full grown and present measurements similar to fully adult birds.

According to Andrews, this gannet begins to breed about January and in October there are great numbers of young birds in grey plumage.

I have birds almost full grown, but with the outer primaries still with a small amount of sheath at the base, and down hanging to the feathers here and there, taken at the end of August and full grown immature birds of the year, free from down, taken in September and as late as 10th November. The series at least proves a complete moult from old to new adult plumage during the second half of August to the beginning of November. One bird, dated 7th November, is in clean fresh

plumage except for the tail in which the moult is not complete. Two October birds are in mottled plumage though mostly white: their old plumage appears to have been grey but as some of the *new* feathers are also not entirely white it is certain that, sometimes, at least, this species has a definite second year phase before obtaining the adult dress.

*Range in Malaysia.*—There are very few records from the Bay of Bengal and the species is not known from the coast of Tenasserim, the west coast of Siam and the Straits of Malacca. There is a reliable record from the Pagi Islands ("Nassau Island") off the west coast of Sumatra. Other records of "Java" and the "Sunda Straits" can also be accepted as from the breeding grounds in the Cocos-Keeling and Christmas Islands, birds must sometimes approach the south coast of Java. Recorded from Bali. The species also breeds in the Paracel Islands in the northern part of the China Sea off the coast of Annam, but it has yet to be recorded from the Gulf of Siam, anywhere along the east coast of the Malay Peninsula, the islands in the south China Sea, or the coast of Sarawak. It is known to breed on Bangkoran and Cavilli Islands in the Sulu Sea and it has been recorded from Sandakan on the coast of British North Borneo. It is said to occur in the eastern part of the Java Sea but I know of no record from the Straits of Macassar. To sum up, this species seems very rarely to approach land anywhere in Malaysia, shunning even the coasts of large land masses near its isolated breeding places.

[Breeds in the trees on the shore terrace; most of the nests observed contained young birds. M.W.F.T.].

*Sula leucogaster* ? *rogersi* Mathews.

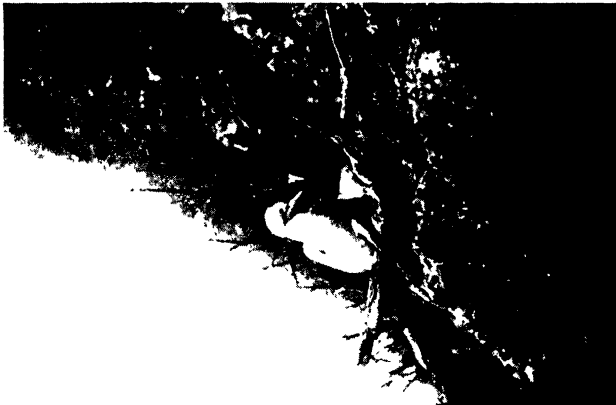
*Sula leucogaster rogersi* Mathews, Austral Av. Rec., 1, 1913, p. 189 (Bedout Island, mid-West Australia).

*Sula sula*, Andrews, Mon. Christ. Island, 1900, p. 44.

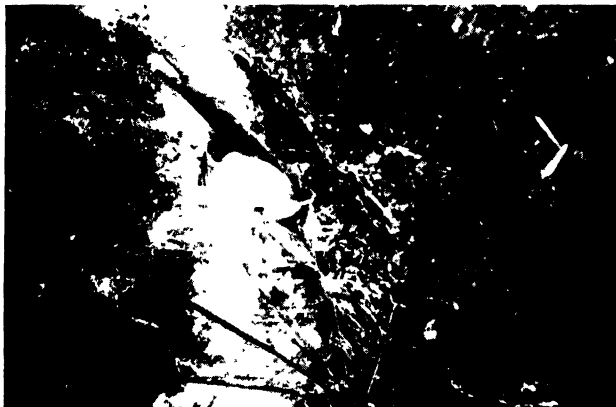
The following are all fully adult birds from Christmas Island.—

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from feathers	Tarsus
♂	780	196	379	118	97	40
♂	..	209	397	..	99	42
♂	784	206	384	..	98	44
♂	..	200	400	..	97	42
♀	830	193	412	181	110	47
♀	..	200	418	..	104	44
♀	755	190	385	122	100	44



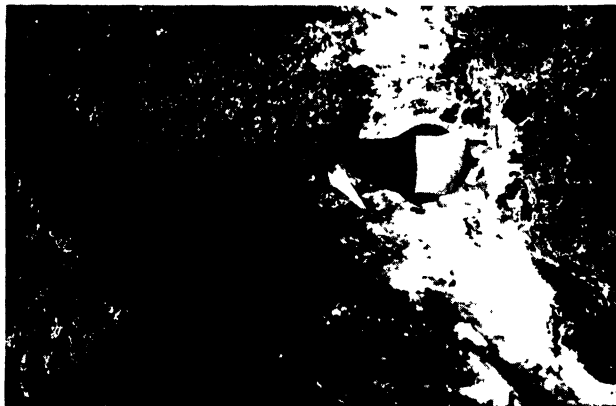


1



2

*The Brown Gannet and young at nest.*  
CHRISTMAS ISLAND, INDIAN OCEAN.



3

## BIRDS

"Iris, grey or putty colour; bill, light greenish blue, nearly white at tip and bluer towards base; bare skin including pouch and orbital skin, dull blue; feet, green to bluish green" (*August September, M.W.F.T.*).

"Feet, pale yellow or greenish yellow" (*October, P. de F.*)<sup>1</sup>.

For critical examination only fourteen of these gannets are available, eight from Christmas Island and six from the Straits of Malacca: as the two series can at once be separated on a decisive character, the smaller, particularly slender and less robust bills of the northern birds it must be assumed that two breeding colonies are represented. The subspecies of this bird have been much discussed but are still ill-defined: Robinson and Kinnear<sup>2</sup> have remarked on the further complication of "strains" developing within the area occupied by what is conventionally recognized as a subspecies.

In plumage all the skins are much alike with the head and neck very slightly darker than the rest of the upper parts, newly moulted birds being rather generally darker and the distinction in the plumage very slightly less noticeable. At the same time it must be noted that, as the authors mentioned above have observed, the distinction is rather more marked in Christmas Island specimens than in birds from the Straits of Malacca. Considering the above facts there seems no other course but to admit two "forms" from Malaysia. With the material at my disposal I can go no further beyond suggesting that perhaps the southern birds breeding at Christmas Island can stand as *rogersi*.

Mr. Tweedie obtained two eggs on 17th September: one contained a well advanced embryo. The eggs measured  $62.8 \times 41.5$  mm., and  $64.6 \times 41.8$  mm. Andrews obtained a juvenile on 4th August and Mr. Tweedie saw a nestling in down on 18th September, (Plate III).

Ridley refers to "nesting" on 7th October and mentions a bird photographed on the nest on 18th October.

The few skins show no sign of a major moult during the last half of August up to 17th September but some dated 10th and 24th October and 21st November have started a complete moult.

*Range in Malaysia.*—In Malaysia this species more often approaches the vicinity of land than *Sula sula rubripes*. It

1. In "The Birds of the Philippine Islands", 1932, p. 406, Hachisuka has written "the male and female are readily distinguished by the fact that the former has the bare skin at the base of the bill and on the throat dark blue, while in the latter it is bright lemon-yellow". These remarks presumably apply to birds from the Philippines. According to Mr. Tweedie's field-notes there is no such sexual difference in the colour of the soft parts in Christmas Island.

2. Bull. Brit. Orn. Club, 48, 1928, p. 64.

seems to be numerous from the Mergui Archipelago through the Straits of Malacca to the neighbourhood of Singapore although normally avoiding the actual coast. According to Robinson it breeds on a rocky island in the Aroa group in mid-channel between the coasts of Selangor and Sumatra. From breeding grounds in the Paracel Islands in the China Sea it strays to the coast of French Indo-China and has been recorded from the Inner Gulf of Siam. Robinson also states that there is a breeding place on a small island off the coast of the Siamese province of Nakon Sritammarat on the east coast of the Malay Peninsula but nothing is known of its occurrence on this side of the Peninsula any further south nor has it yet been recorded from the Anamba and Natuna Islands in the south China Sea. It is known from the coasts of Sarawak, Labuan, and British North Borneo: there are several breeding places in the Sulu Sea. Recorded from both north and south coasts of Java. Breeds in the Cocos-Keeling and Christmas Islands.

*Sula abbotti* Ridgway.

*Sula abbotti* Ridgway, Proc. U. S. Nat. Mus., XVI, 1893, p. 599 (Assumption Island); Andrews, Mon. Christ. Island, 1900, p. 44.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from feathers	Tarsus	Middle toe and claw (dry)
♂	772	206	442	135	110	43	96
♂	761	200	441	136	110	42	95
♀	770	203	450	137	112	45	100
♀	787	206	463	133	111	44	93
♀	761	203	440	135	112	44	95
♀	787	213	463	138	114	44	100

"Iris, dark brown; bill, pale waxy pink to greyish pink, blackish at tip; skin at base of lower mandible and gular pouch, light bluish green; skin at base of upper mandible, and orbital skin, blackish, a light patch on the lower eyelid. Tarsus and first two joints of digits, greenish grey; part of webs bounded by first two joints, greyish blue; distal joints of digits and remainder of webs, blackish; claws, whitish".

All the specimens agree perfectly with Ridgway's description of *abbotti* from Assumption Island north of Madagascar, where, according to authors, it occurs side by side with *Sula dactylatra melanops*. It must therefore be a distinct species.

Except in the degree of wear shown by the plumage the Christmas Island series of adults is fairly uniform: in moulting specimens the old faded brown feathers form a striking contrast to the neat black and white dress of birds in fresher plumage.

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The only published information on the life-history of the bird in Christmas Island that I can trace is Andrews' record of "young" shot in September.

The specimens obtained on the present occasion are dated 1st-2nd September. Four have almost finished a complete moult: the other two are also moulting but are not so advanced.

In Malaysia *abbotti* is known from Christmas Island and the Cocos-Keeling Islands. Specimens of "*dactylatra*" in the Leyden Museum from Java require re-examination: they may be *abbotti*.

### *Sula dactylatra*.

A confusing point is that Mathews in 1927 has specifically included Christmas Island in the range of his *Sula dactylatra bedouti*. Peters (1931) recognizes both *abbotti* and *dactylatra* from the island. If either of these records of *dactylatra* is based on an actual specimen the fact that *four* species of *Sula* breed on Christmas Island would emerge but I doubt if this is so. A form of *S. dactylatra* referred by Bangs in 1922 to *S. d. personata* breeds in the Sulu Sea: it must therefore occasionally visit the north Bornean coast. The same form is also accepted for "Java" by Bartels and Stresemann but it has been suggested that *bedouti* is only very doubtfully distinct from *personata*.

[This species differs markedly from the other sea birds in that it nests, apparently exclusively, in high trees on the inland plateau. During the first week in September the nests probably contained young as the loud and unmistakable sound of the parent birds feeding the nestlings by regurgitation was heard fairly frequently while walking through the jungle. It is not easy to discern the nests although they are easy to locate. Those observed were in the highest branches of tall trees, and inaccessible to any but the most skilful climber. *M.W.F.T.*].

### *Fregata andrewsi* Mathews.

*Fregata andrewsi* Mathews, Austral. Av. Rec., 2, 1914, p. 120 (Christmas Island, Indian Ocean).

*Fregata aquila* (nec Linn.), Andrews, Mon. Christ. Island, 1900, p. 42.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from feathers	Plumage
♂	902	384	610	131	113	Adult
♀	..	390	641	..	131	"
♀	..	420	649	..	135	"
♀	984	415	657	158	135	"
♀	..	433	645	..	130	"
♀	..	..	..	..	126	Juvenile



*Nestling in down*.—"Iris, very dark brown; bill, pale bluish green; feet, greenish white".

*Adult female*.—"Iris, very dark brown; bill, pale pink, upper mandible brownish at the tip; throat, pale pink; feet, very pale pink".

*Adult male*.—"Iris, dark brown; eyelids, black, a light blue patch on the lower lid; bill, dark brown with paler markings; throat, bright scarlet, slightly paler on the interramal space; feet, dark brown, soles, pale pink" (18th September)<sup>1</sup>.

Combining the above measurements with those of other examples from Christmas Island and from the Anamba Islands given in two previous papers<sup>2</sup> the following ranges are obtained for *Fregata andrewsi*.—

*Adult males* (three).—Total length in the flesh 902–920; tail from base of central feathers, 384–; wing pressed flat, 605–610; bill from gape in flesh, 131, 131; culmen, 110–114 mm.

*Adult females* (twenty-one).—Total length (incomplete tails excluded) 985–1020; tail from base of central feathers, 390–433; wing, 630–660; bill from gape in the flesh, 151–160; culmen, 125–135 mm.

Neither in size, colour of the soft parts nor plumage is there any apparent difference between birds from Christmas Island in the Indian Ocean and the Anamba Islands in the south China Sea: some Christmas Island birds are rather paler on the brown wing-bar than Anamba specimens but this is largely a matter of wear and other specimens from the two localities are indistinguishable.

The sequence of plumages is not easy to appreciate on the available material.

*1st Stage*.—The youngest bird is covered with long white down. Contour feathers of the first generation are appearing in three places. There is a crop of pale chestnut feathers on the head; some black remiges (outer secondaries) and, most interesting of all, a saddle-shaped patch composed of some mantle-feathers and scapulars of well-developed brownish grey feathers on the back.

*2nd Stage*.—A juvenile female, well feathered but the outer primaries still in sheath at the base and plenty of down still

1. The soft parts are described by Mr. Stuart Baker as "iris red; bill bluish-grey; gular skin, legs and feet red". This does not agree with my experience of birds from Christmas Island (the type locality) and the Anamba Islands and I expect the explanation is that Mr. Baker has copied Blanford's note placed under "*F. aquila*".

2. Chasen and Kloss, Journ. Mal. Br. Roy. Asiat. Soc., 2, 1924, p. 64; 6, 1928, p. 52.

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showing on the under parts. Head and neck all round, very pale chestnut. Breast white with a broad blackish bar across the middle; some black feathers on the flanks; under tail coverts and thighs black. Mantle, hair-brown with a greyish cast, the feathers slightly paler at the edges. Upper scapulars brown with broad creamy edges, longer feathers blackish. Lower back, rump, upper tail coverts, rectrices, remiges, except the inner secondaries which are grey-brown, and greater wing coverts, black with a blue-green or bluish gloss. Marginal coverts along the inner edge of the wing nearly black; the outermost coverts dark brown with paler edges; between the two dark patches thus formed the wing coverts are creamy white with brown centres, these latter feathers forming a conspicuous pale patch.

*3rd Stage (female).*—Like the adult female but with a broad white collar round the hind-neck continuous with the white of the under parts: glossy plumes on the head and mantle shorter and duller.

*4th Stage (female).*—Like the last stage but the white nuchal colour reduced to a few pale feathers. From this plumage birds moult into the plumage of the adult breeding female: they may therefore be subadults or adults in a *non-breeding* dress.

Notes on the nesting habits are given by Andrews and Stuart-Baker (Faun-Brit. Ind., Birds, 2nd ed. vi) 1929, p. 296): the latter author also describes the eggs.

Andrews records the "pairing season" as extending from January to April; eggs in February and April (specimen in British Museum); still many young birds in white down in August; and young all flying by October.

The present collection includes a downy nestling dated 22nd August and an immature bird with down still hanging on the under parts, but no doubt a flyer, dated 14th November.

Some specimens from the Anamba Islands dated 11th September are in process of a major moult but I am not prepared to say anything definite about the moult in Christmas Island.

*Range in Malaysia.*—The only definitely known breeding place of *Fregata andrewsi* is Christmas Island in the Indian Ocean. It has been recorded from the Cocos-Keeling Islands and Wood-Jones' breeding "*Fregata aquila*" may therefore be *andrewsi* but this is not fully established. From its breeding ground it strays to the coasts of Java but there is as yet no record from Sumatra or the Straits of Malacca. It is true that "*F. andrewsi*" has also been recorded from the west coast of Siam but I cannot trace that the record is based on an actual specimen: old records of "*aquila*" from this region may refer

to *minor*. Across the Indian Ocean it strays to Ceylon and the Malabar coast. It was common in the Anamba Islands in September 1925 but it is not yet recorded from the east coast of the Malay Peninsula although I have seen it at sea about forty miles due east of Singapore Island. It occurs on the Sarawak coast and Dr. P. R. Lowe has recorded an immature bird from "Celebes". "*F. aquila*" from small islands near Billiton may refer to *andrewsi*.

[In trees on the shore terrace near Flying Fish Cove and elsewhere numerous nests were observed containing young birds in various stages of growth. Frigate-birds are the most conspicuous birds on the island and are very common in the settlement where the three photographs on Plate IV were obtained of birds flying overhead. *M.W.F.T.*].

*Gular pouch*.—I cannot fully understand Andrews' remark, "about the beginning of January the adult males begin to acquire the remarkable pouch of scarlet skin beneath the throat". Other authors have made similar remarks in relation to *Fregata*. It seems to me that the *adult male* of *F. andrewsi* always has a bright red gular pouch and no doubt this is only inflated in "display" but it has, I think, yet to be demonstrated that there is any seasonal variation in form.

### ***Fregata minor minor* (Gmel.).**

*Pelecanus minor* Gmelin, Syst. Nat., 1789, p. 572 (type. loc. restr. eastern half of the Indian Ocean, *Rothschild* 1915; Christmas Island, *Lowe* 1924).

*Fregata ariel* (nec G. R. Gray), Andrews, Mon. Christ. Island, 1900, p. 44.

Sex	Total length in the flesh	Tall from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen from feathers
♂	855	390	560	113	96
♂	880	384	570	116	98
♂	859	370	564	116	97
♂	..	..	552	..	95
♂	..	370	566	..	92
♀	930	415	587	131	107
♀	..	..	592	127	107
♀	953	407	582	126	105
♀	910	385	..	129	108

"Irides, brown; bill, bluish grey, brownish at tip, or greyish brown with some steel-grey areas near the tip; gular pouch,

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light scarlet, paler on the interramal space; eyelids, black with a whitish patch on the lower lid; feet, dark brown or light reddish brown, soles, pinkish white" (*male*).

"Irides, brown; upper mandible steel-blue or grey and whitish, darker at tip; lower mandible, steel-grey tinged with pink at base; gular pouch, dull crimson; eyelids, rose pink or dull crimson, a white patch on the lower lid; feet, very pale pink" (*female*).

Little specific has been recorded of this species on Christmas Island beyond the fact that it breeds there though Andrews' observations on the breeding season under "*Fregata aquila*" seem to apply to the present species as well as to *F. andrewsi*.

The skins indicate that there is a major moult extending, at least, from the middle of August to the middle of September.

In 1924<sup>1</sup> Mr. Kloss and I referred three females of *Fregata minor* from the coast of Sarawak and the Moluccas to the subspecies *F. m. aldabrensis* Maths., because of their very dark, glossy backs, although on size they could not be distinguished from the typical race. Further examination of these specimens, however, convinces me that we were at fault and I now see that they cannot be distinguished from some Christmas Island skins. The breeding grounds of *aldabrensis* are in the western part of the Indian Ocean but it has been recorded from Ceylon.

According to Bangs *F. m. minor* occurs in the Sulu Sea between north Borneo and the Philippine Islands: there are probably breeding grounds here also.

The species is also known from the coasts of Java and from Bawean Island and the Thousand Islands in the Java Sea. There seems to be no record from the Cocos-Keeling Islands. A number of records such as Davison's visual records of "*minor*" from Malayan waters in "Stray Feathers" 9, 1880, p. 119 are now impossible to allocate to species. According to Delacour and Jabouille *F. m. minor* nests in the Paracel Islands in the China Sea and occurs along the coasts of French Indo-China.

Two other species of *Fregata* have been recorded from Malaysia but one of these, I think, has no real place in the fauna.

*F. aquila*.—In Cat. Birds Brit. Mus., XXVI, 1898, p. 447, Ogilvie-Grant recorded under this heading a frigate-bird, supposedly from the Hume collection and said to have been obtained by Davison at Malacca. Now, in "Stray Feathers" (l.c.s.) it is especially stated that Davison never collected a frigate-bird. According to the late H. C. Robinson (in. litt.)

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1. Journ. Mal. Br. Roy. Asiat. Soc., 2, 1924, p. 64.

the doubtful specimen which agrees with Ascension Island males of *F. aquila* has no original label. I therefore believe that a mistake in labelling has occurred and it may be observed that the skin has been "remade". On the other hand there is, before me, documentary evidence to prove that a bird shot by Kelham at Pulau Nongsa, a small island in the Rhio Archipelago in the south of the Straits of Singapore<sup>2</sup> was borrowed by Davison and never returned to the owner. The specimen now appears to be lost unless it is a certain old mounted specimen of an immature *F. a. ariel* of doubtful provenance now in the Raffles Museum of which Davison was once Curator.

*F. ariel*<sup>3</sup>.—A form of *Fregata ariel* is the commonest, or at least, the most frequently observed member of the genus in most parts of Malaysia: presumably it is the typical form but owing to lack of material Dr. P. R. Lowe left the subspecific name of the Cocos-Keeling bird open in Nov. Zool., XXXI, 1924, p. 312. The species is found in the Straits of Malacca; along the east coast of the Malay Peninsula and among the islands of the Tioman Archipelago; further afield it is met with among the Anamba Islands in the south China Sea and south to Banka. Also along the coasts of Sarawak and British North Borneo and in the neighbourhood of the Maratua Islands off the east coast of Borneo. It enters the Straits of Singapore but rarely approaches the island itself although I saw three frigates, I think of this small species, flying along the coast during the first week in June 1933. Other records are from the Java Sea and Kangean Islands. It occurs in the Cocos-Keeling Islands, from there straying to the coast of Java but as yet there seems to be no record from the west coast of Sumatra. As curious as the absence of a record of *F. minor* from the Cocos-Keeling Islands is the apparent absence of *F. ariel* on Christmas Island<sup>4</sup>.

According to Robinson and Kloss a frigate-bird of unestablished identity also appears at times, far inland on Korinchi Lake in west Sumatra.

2. Recorded as *Attagen minor* by Kelham in Ibis, 1882, p. 202.

3. Some measurements and notes of Malaysian birds are given in Journ. Straits Br. Roy. Asiat. Soc., 2, 1924, p. 64 and 6, 1928, p. 53. *Males*. Wing, 508-554; culmen, 81-90. *Females*. Wing, 526-578; culmen 88-95 mm. To these can be added a female from Balambangan Island, North Borneo, wing, 580; culmen 90; three females from the Anamba Islands in the South China Sea, wings, 550, 560, 554; culmens, 88, 93, 95; and two males from the same locality, wings, 538, 545, culmens 91 and 87 mm.

4. In Nov. Zool., XXI, 1924, p. 310, Dr. P. R. Lowe has mentioned a specimen from Christmas Island but he has since been kind enough to tell me, in a letter, that although the identification is sound there is just a possibility of a mistake in labelling.

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## *Phaëthon lepturus fulvus* Brandt.

*Phaëthon fulvus* Brandt, Mém. Acad. Imp. Sci. St. Pétersb. (6) 5, 1840, p. 269 (No type locality = Christmas Island, Indian Ocean); Andrews, Mon. Christ. Island, 1900, p. 45; pl. III.

Sex	Total length in the flesh	Tail in the flesh	Head and body	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Exposed Culmen	Tarsus
♂	820	..	..	510	..	..	48	22
♂	864	590	274	582	282	70	49	23
♂	868	596	272	565	282	68	49	22.5
♂	778	502	276	472	288	73	52	22
♂	721	460	261	425	287	68	51	23
♂	..	..	..	484	280	..	50	21
♂	..	..	..	..	295	..	51	22
♀	774	..	..	462	281	..	49	23
♀	870	..	..	553	300	..	53	23
♀	..	..	..	..	283	..	51	22

"Iris, dark brown; bill, yellow, greenish at the base, a small area above nostril, black; feet, webs and distal five-sixths of toes black, rest white or greenish white" (*male*).

"Bill, tip yellow, base greenish" (*male*).

"Iris, dark brown; bill, greenish and bluish grey, brown at tip; feet, greenish white, webs, black" (*immature*).

The total length in the flesh is of little value as a measurement unless the tail is full grown which in the majority of cases it probably is not, but by subtracting the tail measurement taken in the flesh by the method of bending it back over a ruler, a head and body measurement is obtained which is a fair index to the size of the bird.

The sexes are alike in size.

In plumage there is some variation in the amount of black present but in the series males and females can be matched. In all the skins there are at least concealed black spots on the lower rump and upper tail coverts, although in some cases these are reduced to the shaft stripes only; occasionally these spots are obvious as in immature birds. Black markings on the outer under tail coverts are also normal. The shafts of the primary coverts are mostly black but the presence of black on the inner web of these feathers is purely an individual character. The beautiful deep apricot colour of the living adult, unfortunately fugitive after death, is in the nine months old skins before me deepest on the upper parts, especially on the head, neck and

mantle. On the wings and under parts there is the faintest suggestion of pink<sup>5</sup>.

Andrews has suggested that the yellow is acquired before the bird flies which seems very curious as the first true feathers are white. Furthermore an immature bird of the year shows no trace of yellow although it had left the nest and Sharpe states that his juvenile, "just beginning to fly" has no orange in the plumage.

An egg in the British Museum is dated 25th December and Andrews mentions eggs and young obtained in August and September: Sharpe lists a juvenile just beginning to fly dated 20th September. I have a downy nestling dated 10th October. An immature bird of the year is dated 28th August. Late August and early September adults are in good feather and give the impression of having not long completed a general moult. There are no signs of a major moult in a small series of November birds. The immature plumage has been well described by Sharpe but sometimes there are two black spots at the end of each tail feather.

***Phaëthon rubricauda westralis* Mathews.**

*Phaëthon rubricauda westralis* Mathews, Austral. Av. Rec., 1, 1912, p. 88 (West Australia).

*Phaëthon rubricauda*, Andrews, Mon. Christ. Island, 1900, p. 45.

Sex	Total length in the flesh	Tail in the flesh	Head and body	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Exposed Culmen	Tarsus
♂	746	397	349	363	324	91	65	29
♂	771	..	..	410	336	..	64	28
♀	760	394	366	364	340	93	65	30
♀	725	379	346	345	315	90	61	29
♀	771	..	..	320 *	335	..	64	30
♀	765	..	..	385	330	..	61	30

"Iris, dark brown; bill, bright orange-red, brownish at base, a small area above nostril black; tarsus and proximal part of digits whitish or bluish white, remainder of feet black" (*male*).

"Bill, bright orange-red, paler at base" (*female*).

The variation in the length of the wing seems rather large, 315-340 mm. in the same sex but the wings seem full grown and

<sup>5</sup>. It has been said that this apricot tinge is the only character separating *fulvus* from *lepturus* but a rigid comparison of the two forms seems desirable.

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the measurements fair. Mathews originally separated *westralis* on its long wing and later added rosier coloration and smaller bill to its subspecific characters. I can imagine no bird in which the rosy flush on the feathers could be more delicately suggested than in even the freshest of the skins before me. Using Mathews' figures for the typical form no difference can be maintained between birds from Christmas Island and typical *rubricauda* on wing-length: the ranges are 315-340 against 320-336 mm., but the Christmas Island birds certainly seem to have rather smaller bills; culmen, 61-65 against 76-80 mm.

Andrews mentions a juvenile taken in August.

Six birds dated from 16th September to 11th November show no sign of a major moult.

\* \* \* \* \*

What little is known of the distribution of tropic-birds in Malaysian waters is summarized below.—

*P. l. lepturus*.—Ogilvie-Grant (Cat. Birds Brit. Mus., 26, 1898, p. 454) placed Nicholson's record (Ibis, 1882, p. 70) of "P. candidus" relating to a specimen obtained by Forbes in the Cocos-Keeling Islands under this heading, but wrongly quoted Java as the locality. Wood-Jones (P. Z. S., 1909, p. 141), however, records the Cocos Island breeding *Phaëthon* as *rubricauda* but judging from a photograph and note, given to me by Mr. C. Clunies Ross the former author's view seems correct. *P. lepturus* reaches the Andaman Islands and the Burmese coast (Pegu) but it is not recorded from either coast of Siam, French Indo-China, southern China, or anywhere in Malaysia although it seems reasonable to suppose that it sometimes wanders near the west coast of Sumatra and to the northern entrance of the Malacca Straits.

*P. l. fulvus*.—This can only be a local form of the preceding. Its only known breeding place is Christmas Island in the Indian Ocean and it seems to have a very restricted range. It has not been definitely recorded from the Cocos-Keeling Islands: but Wood-Jones (l.c.s.) who does not include it in his list of birds rather ambiguously remarks that it is to be seen everywhere between the atoll and Java Heads. Mr. C. Clunies Ross tells me that it is a non-breeding visitor to the islands. Travellers to Christmas Island have noted that it first appears about half-way between the coast of Java and the island but there is no reliable record for either the Sumatran or Javan coasts: nothing is known of its range to the south and east. It is interesting to note that this bird of whose range we still know so little seems to have been known to Brisson but the thought at once occurs as to



whether any of the other races of *lepturus* are ever creamy or yellow in any stage or phase of plumage.

*P. rubricauda westralis*.—In Malaysian waters I know this form with certainty only from the Cocos-Keeling and Christmas Islands in both of which places it breeds. In Mus. Pays-Bas, VI, Pelecani, p. 44 dated 1863, Schlegel has printed, "Passe souvent au détroit de la Sonde, et ne s'arrête guère sur Java (de Bocarmé, notes manuscrites)" but there seems no other evidence for the inclusion of this species in lists of Sumatran and Javan birds. It occurs in the Bay of Bengal but it is not known from the south China Sea or from the coasts of Siam and French Indo-China.

*P. aethurus indicus*.—This is the third species known from Malaysia. Davison met with it off the southern point of Tenasserim (Stray Feathers, VI, 1878, p. 493) but apparently did not secure a specimen. The species must certainly be regarded as very rare in Malaysia and the only bird on record is that now in the British Museum and obtained by Dr. Cantor in the Straits of Malacca, probably in the vicinity of Penang. In "Les Oiseaux de l'Indochine Française" 1, 1931, p. 31, Delacour and Jabouille record it as nesting in large numbers in the Paracel Islands off the coast of Annam.

#### A NOTE ON THE TAIL MOULT IN PHAETHON

In none of the skins of *Phaëthon lepturus fulvus* are the two long rectrices of equal length although in tails that seem full grown the difference is not great. An interesting point is that either obviously or by careful examination of the base of the shaft, there always seems to be a considerable difference in the age of the two feathers and in the only two specimens in which the tail is full grown the longer feather is the newer. The longer feather in the tail may be either on the right or left side. From the fact that feathers still in the sheath at the base are sometimes worn in appearance these long rectrices evidently take a long time to grow. Tails also occur in which there is one long, fully grown feather and one very much shorter feather in sheath. These facts suggest that the two feathers are moulted alternately, the old feather dropping when the new one is full grown. This may be the case sometimes but I have seen birds in which *both* feathers are still in sheath although very unequal in length and we must assume that sometimes the feather on one side is dropped and the new feather starts to grow before that of the other side has reached

1. But inadvertently (fide M. Jean Delacour in litt.) omitted from the same authors "Oiseaux des Îles Paracels" (1930).

its maximum development. If this is so, we have in one species, perhaps irregularly in the life history of the individual, evidence of the process by which a perfect alternating moult of these feathers may be evolved.

A somewhat similar, interesting irregularity in the moulting of the long central pair of tail feathers has been noticed in the hornbill, *Rhinoplax vigil*. Dr. A. Wetmore<sup>2</sup> has noticed that in adults of this bird there is often one long, worn, fully grown feather and one short, new, growing feather and that if both feathers are approximately the same length, one is noticeably a feather of a previous moult about to be shed. He concludes that "one feather of the central pair is developed at one time and this spike, much longer than the other rectrices, on reaching maturity, remains in position for more than a year, probably for two. Its companion, beginning its growth after the other has gained its extreme length, then equals it in size. The first feather is then moulted and is gradually replaced by another, so that in the renewal of this central pair there is a continual alternation instead of the usual method by which these feathers are renewed synchronously on the right and left sides".

In some examples of *Rhinoplax vigil* the moult may proceed as Dr. Wetmore suggests but other skins before me show quite definitely that this is not always the case. In two adults one feather is one or two inches longer than the other but *both* feathers, which are fairly long and project well beyond the other tail feathers, are in sheath at the base and have obviously grown together.

In an immature *Phaëthon l. fulvus* the full-grown, slightly lengthened central rectrices are exactly alike in length and age.

This irregularity of moult is, I think, not uncommon in birds in which the central tail feathers are lengthened. In six *Phaëthon rubricauda* only one very long tail feather is present: it may be right or left and the opposite feather is always less than half its length. The long feather is in all cases full grown, the short feather never entirely out of sheath. On this small series there is therefore nothing against the theory of a perfect alternating moult in this species which has a very "specialized" tail the evolutionary process mentioned in connection with *P. l. fulvus* having proceeded to its conclusion.

***Accipiter fasciatus natalis* (Lister).**

*Urospizias natalis* Lister, P. Z. S., 1888, p. 523 (Christmas Island, Indian Ocean).

2. "A Peculiarity in the Growth of the Tail Feathers of the Giant Hornbill (*Rhinoplax vigil*)", Proc. U. S. Nat. Mus., 47, 1914, p. 497.

*Astur natalis*, Sharpe, Mon. Christ. Island, 1900, p. 46.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen without cere	Tarsus	Middle toe without claw
♂ ad.	353	164 +	229	25	16	61	35
♂ ad.	363	171	228	23	16	60	33
♂ ad.	..	164	220	..	16	58	31
♂ ad.	..	161	..	..	16	..	31
♂ imm.	..	171	220	..	16	57	33
♂ imm.	360	175	227	30	16	61	31
♂ imm.	..	173	225	..	16	57	34
♀ ad.	..	199	..	..	21	72	40
♀ imm.	..	203	..	..	21	73	41
♀ imm.	..	199	262	..	20	..	40

"Iris, yellow; bill, blackish; cere, yellow; feet, yellow" (*adult male*).

"Bill, dark brown, light grey at base" (*adult male*).

"Iris, orange; bill, black; cere, green; feet, yellow" (*immature male*).

The adult males have no rufous on the chin and throat which are white freckled with grey: in an adult female there is a rufous wash. All the males examined retain a small patch of chestnut feathers on the inner lesser wing coverts. Perhaps even this disappears with age: in all other particulars of plumage the sexes seem alike.

I have followed Stresemann<sup>1</sup> in placing this short-toed goshawk "*Urospizias natalis*", in the formenkreise *Accipiter fasciatus* which has no Malaysian representative, its Australian, Papuan, and Austro-Oriental forms extending from the Fiji Islands and Tasmania to Lombok. Owing to lack of material I could not compare *natalis* with its nearest neighbours *A. f. tjendanae* of Sumba and *A. f. hellmayri* of Timor, but Dr. Erwin Stresemann very kindly made a detailed examination of two skins sent to Berlin and the following is the substance of his remarks. The Christmas Island hawks were compared with *A. novaehollandiae sylvestris* and with *A. fasciatus wallacei* and *A. f. stresemanni*: *A. f. tjendanae* is a very different looking race, near the Australian *fasciatus*. Although the wing-formula is not characteristic it seems certain that *natalis* is really a race of *fasciatus* and not of *novaehollandiae*. This is suggested by the presence of a complete rusty collar, the dark colour of the grey upper parts, which is exactly as in *A. f. stresemanni*, and the very narrow, faintly white cross-bars of the under side, in

1. Journ. für Ornith., 72, 1924, p. 444 and 73, 1925, p. 322.

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which character *natalis* is very near *stresemanni* but the former has the bars restricted to the belly whereas in the latter the whole breast is barred. *Natalis*, *wallacei* and *stresemanni* agree in having narrow white cross-bars on the inner web of the secondaries whereas in *sylvestris* the inner web is mostly pure white. The juvenile plumage of *natalis* is quite different from that of *A. f. stresemanni*, *A. f. wallacei* and *A. n. sylvestris*: in *natalis* the under parts are broadly barred, in *stresemanni* and *wallacei* they are marked with broad, longitudinal, lanceolate stripes recalling the juvenile plumage of *A. n. dampieri*. Mr. Tweedie records the cere as "yellow" in the flesh (in skins it usually dries to blackish but occasionally retains its yellow colour, at least in part). In the specimens before me the second primary is considerably shorter than or about equal to the sixth.

Andrews mentions a nest containing one young on 24th January. Some adults at least undergo a complete moult at the end of August and in September.

***Ninox forbesi natalis* Lister.**

*Ninox natalis* Lister, P. Z. S., 1888, p. 525 (Christmas Island, Indian Ocean); Sharpe, Mon. Christ. Island, 1900 p. 47.

The collectors were fortunate in obtaining seven specimens.—

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen without cere	Tarsus
♂	258	120	192	23	15	35
♂	280	119	188	25	15	33
♂	261	117	188	24	15.5	34.5
♀	273	124	197	25	16	34
♀	281	121	198	24	15	34
♀	285	121	196	23	15	34
♀	287	118	196	25	16	34

"Iris, lemon yellow; bill, light bluish grey or greenish brown; feet, pale yellow".

In the above series females are slightly longer in the wing than males: 196–198 against 188–192 mm.

This striking cinnamon-rufous owl has its nearest ally in *N. forbesi* of Timor Laut in the Tenimber Islands and the two forms seem sufficiently close to be united under one specific name.

Variation in colour in *N. f. natalis* is individual and not sexual. Some birds are rather whiter on the under parts owing to the rufous cross bars being paler or the white bars narrower: these paler birds are also faintly spotted on the mantle but there seems no reason for supposing them to be immature.

Nothing is known of the breeding season or the details of nidification.

All the skins, dated 31st August—10th September, seem in fresh plumage: occasionally an outermost primary is not fully grown.

[All the specimens were obtained by the Dayak collectors, who, by virtue of their exceptionally keen sight, were able to see the birds, sitting motionless on trees in the jungle, usually about ten or fifteen feet from the ground. *M.W.F.T.*].

*Collocalia esculenta natalis* Lister.

*Collocalia natalis* Lister, P. Z. S., 1888, p. 520 (Christmas Island, Indian Ocean); Sharpe, Mon. Christ. Island, 1900, p. 48.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Tarsus
♂	96	47	104	9.5	8
♂	98	44	100 <sup>2</sup>	10	8
♂	98	45	104	10	8
♂	95	47	103	9.5	7
♂	99	45	102	10	7
♀	101	45	101	9	..
♀	98	45	102	9.5	..
♀	99	44	102	10	..
♀	97	46	101	10	..
♀	99	..	105	9.5	8

"Iris, dark brown; bill, dark brown to black; feet, dark reddish brown".

The sexes seem alike in size and in plumage, and in both the three outer rectrices are white at the base on the inner web. The tarsus is bare but there are sometimes minute feathers on the ankle. With its white-spotted rectrices the Christmas Island swiftlet is quite unlike any Malaysian form of *C. esculenta* although in its dull upper parts it is nearest to the Javan *linchii* which extends east to Lombok. *C. e. natalis* most nearly resembles two forms of the species inhabiting the island chain from Sumbawa east to Roma and Dammer and because it is strongly green above it is nearer to the more remote of these two forms (*neglecta*) which inhabits Savu, Alor, Timor and other islands yet further to the east, than to the blue-backed *sumbawae* of Sumbawa, Sumba and Flores. North and east of the range of *sumbawae* and *neglecta*, in the Celebes, Moluccas, West Papuan Islands, New Guinea etc. is the glossier *C. e. esculenta*.

<sup>2</sup>. The smallest example of *C. natalis* I have seen has the wing 97 mm. in length.

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The nesting habits appear to be entirely unknown. Birds collected between 25th August and 11th September are in fresh plumage.

[In places where they are flying in a restricted space, such as a narrow part of a jungle patch these swiftlets can be caught on the wing with a butterfly net. Although they are very abundant, no sign of their nesting places was discovered although several caves were visited. *M.W.F.T.*].

### *Turdus javanicus erythropleurus* (Sharpe).

*Turdus erythropleurus* Sharpe, P. Z. S., 1887, p. 515 (Christmas Island, Indian Ocean).

*Merula erythropleurus*, Sharpe, Mon. Christ. Island, 1900, p. 49.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Bill from nostril	Tarsus
♂	227	87	115	29	16	34
♂	..	88	116	..	15	33
♂	..	88	117	..	16	33
♂	..	91	119	..	15	33
♂	..	84	115	..	15	33
♀	220	86	111	31	15.5	32
♀	208	78	105	30	15.5	33
♀	212	82	107	29	14	31
♀	..	77	110	..	15	32
♀	..	82	110	..	15	32

"Iris, dark brown; lids, yellow; bill, orange; feet, orange yellow" (adult).

"Bill, dull orange-yellow; feet, dull yellow" (imm.).

In the above series males run very slightly larger than females. It has been stated that the sexes are alike in plumage but excluding one bird which is probably wrongly sexed I find that males have the throat only very slightly, if at all paler than the brownish grey of the cheeks and breast, whereas the throat in females is noticeably paler, and in fresh skins the breast is a shade more fawny and less grey: furthermore, the rufous of the under parts averages slightly less intense in females which also often have the bill washed with brownish-black. There is no reason to suppose that the females described above are immature as one certain young bird, although not in juvenile dress, has the breast even less grey and more ochreous, the throat washed with the same colour and small yellow spots on a few of the greater wing coverts.

This thrush has been compared with species from west Africa and Fiji but its true affinities are with *Turdus javanicus*, the forms of which are found at high altitudes in Sumatra, Java, Borneo, Celebes and Timor. *T. j. erythropleurus* is paler than any other form and it has a larger bill but it is nearer to *celebensis* and *schlegeli*, the latter from Timor, than to any of the Malaysian forms which are all much darker.

Andrews refers to the "pairing-season" as December-January with eggs in December and young birds just able to fly from February to April.

I have adults and immature birds in clean fresh plumage collected at the end of August: some birds are a little faded by the middle of November.

***Zosterops natalis* Lister.**

*Zosterops natalis* Lister, P. Z. S., 1888, p. 518, pl. XXVII (Christmas Island, Indian Ocean); Sharpe, Mon. Christmas Island, 1900, p. 49.

Sex	Total length in the flesh	Tail from base of central feathers	Wing pressed flat	Bill from gape in the flesh	Culmen	Tarsus
♂	..	46	59	..	10	21
♂	..	46	60	..	12	23
♂	118	49	62	..	11	21
♂	130	49	61	16	11	21
♂	127	47	61	16	11	21
♂	130	48	62	17	12	22
♂	131	50	63	16	11	21
♂	..	48	60	..	11	21
♀	119	46	60	16	11	21
♀	..	48	59	..	11	21
♀	117	46	60	..	11	21
♀	120	46	61	..	11	20
♀	130	47	62	17	11	20

"Irides, chestnut brown; bill, black or dark brown, the base of the lower mandible grey; feet, greenish grey".

Lister's original description is very good: the newly moulted bird has the forehead much yellower than the remainder of the upper parts and the ear-coverts delicate French grey.

It must be freely admitted that *Zosterops natalis* is so unlike any other known form of the genus that to include it in any formenkreise would be an action based on little more than guess-work. In the original description Lister thought its nearest ally

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was *Z. mysorensis* from the Island of Misori in Geelvink Bay, New Guinea, no doubt largely because *mysorensis* and *natalis* both lack the yellow throat so general in the genus but it must be noted that *natalis* is a much larger bird with a white eye-ring, the latter an important feature, said to be lacking in *mysorensis*. Stresemann places *natalis* near *chloris*, which is I think a better guess than Lister's, and even hints that *natalis* and the *chloris* forms are genetically related. According to Stresemann's own arrangement the forms of *chloris* are essentially Austro-Oriental in their distribution but they occur in the extreme west of the Papuan subregion: in Malaysia there is only an infiltration through the Java Sea by way of a few very small islands. The *chloris* forms range from the Thousand Islands north of Batavia in the west of the Java Sea to the small islands in the Sunda Sea, Celebes and thence by way of some small islands east to the Kei Islands, but in the lesser Sunda Islands only as far east as Flores. But a non-Malaysian species, *Z. citrinella* Bp., in appearance quite distinct from *chloris*, occurs as far west as Sumba, thence along the chain of islands by way of Timor and the Tenimber Islands to the islands in the Torres Straits: it excludes the forms of *chloris* whose range lies to the west and north. *Zosterops citrinella* is my choice for the nearest living relative of *natalis*. The forms of *chloris* (of which *flavissima*, *intermedia* and *maxi* are before me) are small birds, entirely yellow below: *citrinella* as illustrated by *bassetti* is a much larger bird, resembling *natalis* in its long tarsus, tail and wing. On the under side *citrinella* races are yellow only on the throat and under tail coverts: the white of the remaining under parts is washed with pale fawn. In fresh plumage *natalis* is *always very faintly yellow on the under tail coverts* but I have never seen any trace of yellow on the throat: it is also washed with fawn on the under parts.

Andrews obtained eggs in November but said that the bird seemed to breed nearly all the year round: I have a juvenile dated 20th October.

Some birds shot at the end of August are in fresh new plumage: others at the beginning of November are worn and faded.

### A LIST OF THE BIRDS RECORDED FROM CHRISTMAS ISLAND

The names in the second column are those used by Sharpe in Andrews' "Monograph" or by Chasen and Kloss in 1924 when they differ markedly from those used in the present paper. This feature has been added for the convenience of Government officers and others stationed on the island in the hope that



they will not be deterred from studying the birds of Christmas Island by initial difficulties in nomenclature.

**TRERONIDAE**

*Ducula rosacea whartoni* (Sharpe)

*Carpophaga whartoni.*

*Myristicivora bicolor bicolor* (Scop.)

**COLUMBIDAE**

*Chalcophaps indica natalis* Lister

**RALLIDAE**

*Limnobæus fuscus fuscus* (Linn.)

**LARIDAE**

*Anous stolidus pileatus* (Scop.)

**CHARADRIIDAE**

*Charadrius apricarius fulvus* Gmel.

*Charadrius dominicus.*

*Charadrius leschenaulti leschenaulti* Less.

*Ochthodromus geoffroyi.*

*Numenius phæopus variegatus* (Scop.)

*Tringa incana brevipes* (Vieill.)

*Heteractitis brevipes.*

*Tringa nebularia* (Gunn.)

*Tringa hypoleucos* Linn.

*Crocethia alba* (Pall.)

*Calidris ruficollis* (Pall.)

*Capella stenura* (Kuhl.)

*Calidris arenaria.*  
*Limonites ruficollis.*  
*Gallinago sthenura.*

**GLAREOLIDAE**

*Glareola pratincola maldivorum* Forst.

*Glareola orientalis.*

**ARDEIDAE**

*Egretta eulophotes* (Swinh.)<sup>1</sup>

*Demiegretta sacra sacra* (Gmel.)

*Butorides striatus amurensis* Schr.<sup>2</sup>

**ANATIDAE**

*Anas gibberifrons gibberifrons* S. Müll.

**FREGATIDAE**

*Fregata andrewsi* Maths.

*Fregata minor* (Gmel.)

*Fregata aquila.*  
*Fregata ariel.*

**SULIDAE**

*Sula sula rubripes* Gould

*Sula abbotti* Ridgw.

*Sula leucogaster ? rogersi* Maths.

*Sula piscatrix.*

*Sula sula: Sula leucogaster plotus.*

1. Sharpe, Cat. Birds Brit. Mus., xxvi, 1898, p. 143.

2. Wing, 203 mm.

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## PHAETHONTIDAE

*Phaëthon rubricauda westralis* Maths.

**Phaëthon lepturus fulvus** *Brandt*

## FALCONIDAE

**Accipiter fasciatus natalis (Lister)**

*Astur natalis.*

## BUBONIDAE

**Ninox forbesi natalis** *Lister*

## MICROPODIDAE

**Collocalia esculenta natalis Lister**

## CUCULIDAE

**Chalcites basalis (Horsf.)**

**HIRUNDINIDAE**

**Hirundo rustica gutturalis Scop.**

**TURDIDAE**

**Turdus javanicus erythropleurus**  
(Sharpe)

*Merula erythropleurus.*

## STURNIDAE

**Aethiopsar grandis javanicus (Cab.)**

*Gracula religiosa religiosa* Linn.

*Gracula javana*  
*javana.*

## PLOCEIDAE

**Munia oryzivora oryzivora (Linn.)**

## MOTACILLIDAE

**Motacilla cinerea caspica (Gmel.)**

**Motacilla flava ? simillima Hart.**

? *Anthus novæzealandiæ malayensis*  
*Eyton.*

*Motacilla melanope.*

*Motacilla flava.*

*Anthus richardi  
malayensis.*

## ZOSTEROPIDAE

**Zosterops (? citrinella) natalis** *Lister*

In addition to the species definitely recorded from the island on the strength of specimens obtained a few other birds have been noted but not collected from time to time by various observers. Several such are mentioned in Andrews' monograph. On page 301 there is a reference to "the rails, of which at least two species were seen". The identity of the second species must remain in doubt for only *Limnobaenus fuscus* is included in the island list. Then on the next page we read of a "fishing-hawk" which could be one of several species and, "a number of *white-headed swifts* which remained for some days".

A resident of the island visiting Singapore once called at the museum for the purpose of seeking information about a bird he had seen: from his description I suspect that the species was the Nicobar pigeon, *Caloenas nicobarica*.

There can be no doubt that the list of regular migrants and stragglers known to visit the island could be greatly lengthened by further observation.

## The Geometridae of Christmas Island, Indian Ocean

By LOUIS B. PROUT

When Hampson made his contributions towards the working-out of the Lepidopterous fauna for the "Monograph of Christmas Island" (Brit. Mus. (Nat. Hist.) 1900), our knowledge of the Geometridæ of the Indo-Australian Region—with the exception of a few scattered patches, chiefly British India, New Zealand and perhaps Australia—was absolutely in its infancy. It is therefore not altogether surprising that his list stands badly in need of revision. The receipt through Mr. H. M. Pendlebury of the Selangor Museum, of a very interesting consignment of forty-two specimens of the family recently collected by Mr. M. W. F. Tweedie and the necessity of describing some new species contained therein have provided the occasion for such a revision, and I am pleased to learn that the Raffles Museum, to which Mr. Tweedie is now attached, is publishing reports on all the groups collected.

The following catalogue is so arranged as to serve the double purpose of supplementing Hampson's and registering the Tweedie collection. The species contained in the latter are marked with asterisk and the numbers of specimens of each, with any comments which have seemed desirable, are recorded under the respective headings.

By the kindness of the Director of the Raffles Museum Singapore the types of the new species have been presented to the British Museum and a generous donation of duplicates has been made to my own collection.

### Subfam. *Hemitheinae*

#### \**Thalassodes subviridis* Warr.

"*Thalassodes veraria* Guen." Hmps., *Mon. Christmas Isl.*, p. 71 (1900) (err. det.).

*Thalassodes subviridis* Warr., *Nov. Zool.* xii, 10 (1905); Prout in Seitz, *Macrolep.* XII, 100 (1933), (Christmas Island).

8 ♂♂, 4 ♀♀, in beautiful condition.

Not variable. The "pale" dorsal line (Warren) may quite justly be called white, though it becomes slightly more creamy posteriorly. Hampson apparently overlooked this distinction from *veraria* and underrated the colour-difference, though he does suggest that the latter may point to a new species. As Warren says, the nearer affinity seems to be with *dorsilinea* Warr. (1903, N. Queensland, New Guinea, Key Islands, etc.), though all the three species named belong to the same section of the genus.

**\*Hemithea (Chlorissa) hyperymna** sp. n.

♀, 24 mm. Face green (partly abraded). Palpus long, 2nd joint extending considerably beyond frons, 3rd joint long, deflexed. Antenna scarcely ciliate. Crown green, fillet very narrowly white. Thorax and abdomen green above, whitish beneath; abdomen not crested. Hind tibia with proximal spurs obsolete.

*Forewing* moderately broad, apex not acute, termen very gently curved, not very oblique, Sc<sup>1</sup> free, Sc<sup>2</sup> rather long-stalked, separating little before Sc<sup>5</sup>, R<sup>1</sup> shortly stalked, M<sup>1</sup> just stalked; grape green, more bluish in distal area; costal edge narrowly whitish buff, very faintly dark-dotted; the white lines fine, antemedian extremely faint, postmedian at well beyond two-thirds, scarcely sinuous; no terminal line; fringe more whitish, feebly grey-spotted at the vein-ends.—*Hindwing* moderate, with small right-angled tooth at R<sup>3</sup>; R<sup>1</sup> and M<sup>1</sup> both stalked; as forewing but without 1st line, postmedian rather more proximal, obtusely bent about M<sup>1</sup>, a green cell-dot slightly better indicated than on forewing; fringe-dots at R<sup>3</sup>, M<sup>2</sup> and SM<sup>2</sup> rather more distinct.

Underside more yellowish; postmedian line broadened, concisely white; distal area fuscous blackish, at termen narrowly white, the white running proximad a little between the veins; fringe whitish.

1 ♀.

A charming little species, of somewhat doubtful origin though clearly a *Hemithea* in the super-generic sense. The loss of the proximal spurs is probably a secondary and perhaps inconstant development (as in some African *Chlorissa* ♀♀).

**Comostolopsis regina** Th.-Mieg.

*Comostolopsis regina* Th.-Mieg, *Misc. Ent.*, XXIII, 323 (1915), (Christmas Island).

Based on a single ♀, in imperfect condition.

Subfam. *Sterrhinae*.

**\*Anisodes hypomion** sp. n.

♀, 22 mm. Face pale, narrowly red above. Palpus slender, over 2, 2nd joint nearly 1; partly red above. Antenna not noticeably roughened at base. Vertex whitish.

*Forewing* normally shaped (costa very little curved, apex moderate, termen smooth, slightly bowed); subcostals on a long stalk from not greatly beyond middle of cell (venation of sect. *Stibarostoma* and other specialised *Anisodes*), M<sup>1</sup> from close to end of cell; ground-colour approaching light pinkish

cinnamon, but with the grey irroration so strong as to produce a general impression of a tone little brighter than vinaceous buff; cell-mark large, irregularly long-oval, weakly dark-outlined and enclosing pale scaling, but not conspicuous; markings grey; antemedian from costa at little beyond one-fourth, excurved anteriorly, then running somewhat obliquely inward; median shade rather broad and diffuse, rather strongly oblique, from about  $\frac{2}{3}$  costa to little beyond middle of hindmargin; postmedian slender and rather weak, but with blackish marks (minute dashes) on the veins, approximately  $2\frac{1}{3}$  mm. from termen, but noticeably incurved between the radials and very slightly receding from termen anteriorly to  $R^1$ ; suggestions of dark shading between the radials at and just outside the postmedian; terminal dots rather small, reddish, placed midway between the veins; minute vein-dots at base of the fringe, which is rather paler.—*Hindwing* with termen rounded, very faintly crenulate; DC straightish,  $SC^2$  just separate,  $M^1$  very shortly stalked; markings of forewing continued; median shade central, less oblique than on forewing, postmedian less incurved between the radials but also with an inward curve (very slight) between  $M^1$  and  $SM^2$ ; no appreciable subterminal clouding.

Underside considerably paler, with indications of cell-marks (especially that of forewing) and postmedian dots.

1 ♀.

As the sole example is worn, the above description may be defective in some details; only special faunistic considerations have warranted its publication without the aid of the ♂ and of more perfect specimens. It is probably near *ampligutta* (Warr., 1891, as "*pallida* Moore ab.") or to the section *Stibarostoma* Warr. (*turneri* Prout, *griseata* Warr., etc.) but may possibly represent the *decretaria* Walk. (1861) group.

### **Scopula** sp.

*Craspedia* sp. Hmps., *Mon. Christmas Island*, p. 72 (1900).

"East Coast, October 1897, C. W. Andrews".

The specimen referred to by Hampson as "one ♀ in too bad condition to identify, apparently allied to *C. eulomata* Snell." is in the British Museum collection and is a rather narrow-winged *Scopula* with the shape and apparently the markings of *delospila* (Warr., *Nov. Zool.* xiv, 140, New Guinea, with near relatives in Australia), but with stronger irroration and slightly larger terminal dots (triangles). As I cannot say that it may not belong to some known species, I am reluctantly compelled to leave it unnamed. As it is quite certainly not a form of *tumiditibia*, we have two known *Scopula* from the island.

**\*Scopula tumiditibia** Prout.

"*Craspedia optivata* Walk." Hmps., *Mon. Christmas Island*, p. 71 (1900) (err. det.).

*Scopula tumiditibia* Prout, *Nov. Zool.* xxvii, 298 (1920), (Christmas Island).

2 ♂♂, 1 ♀.

It is curious that Hampson failed to appreciate the very great difference between the ♂ hindleg of this species and that of the Australian *optivata*, the more so since he comments on some differences in their wing markings, which should have aroused his suspicion. In *tumiditibia* ♂ the hindleg in the ordinary position (sharply bent at the knee) reaches to the end of the abdomen, as in no other *Scopula* known to me; in *optivata* it is of normal length. In both, the tarsus is extremely short, but even here *optivata* is less extreme than *tumiditibia*.

Subfam. *Larentiinae***\*Ecliptopera phaula** sp. n.

♂, 32 mm. Much like a diminutive and rather dark *dissecta* (Moore, 1887), from Ceylon and S. India. Antennal ciliation relatively a trifle longer (well over  $\frac{1}{2}$  diameter of shaft).—*Forewing* with median costal blotch reaching  $M^2$  (in *dissecta* not quite so far, at least the white border of the blotch intervening), its distal edge more regular (only extremely slightly convex in posterior part), without the anterior sinuosity found in *dissecta*.—*Hindwing* with the postmedian also more regular.—Underside less pale than in *dissecta*, forewing apparently quite without the dark blotch between  $R^3$  and  $M^2$  and with some other differences of detail.

The single specimen is unfortunately a good deal worn, but easily recognizable, the more so as it is in the highest degree unlikely that any near relative inhabits the island. The distribution of the genus is chiefly from the Himalayas to Japan and Formosa, though a very few species are known from Malaysia.

**Sauris remodesaria** Walk.

*Sauris remodesaria* Walk., *List Lep. Ins.* xxiv, 1253 (1862), (Ceylon).

"*Sauris hirudinata* Guen." ♂, Hmps., *Mon. Christmas Island*, p. 71 (1900), (err. det.).

Only known to me from the one ♂ recorded by Hampson, which may represent a variety. The range of the species—which is one of the many that were merged by Hampson in *hirudinata*—is very wide, extending to Formosa, the Philippines, Borneo and through the Lesser Sunda Islands to Timor; the geographical variation has not yet been worked out. For Hampson's supposed "3 ♀♀" see the following species.

**\**Sauris pelagitis* sp. n.**

"*Sauris hirudinata* Guen." ♀, Hmpsnn., *Mon. Christmas Island*, p. 71 (1900), (err. det.).

♂ ♀, 25–26 mm. Palpus in ♂ over  $2\frac{1}{2}$ ; in ♀ just over 3. Antenna thick, tapering a little proximally and with the usual fine apical joints of *Sauris*, no sinus in upperside. Head and upperside of body predominantly green: 1st joint of palpus whitish, antenna fuscous; underside of body dirty whitish. Hindleg of ♂ slender, without pencil.

*Forewing* with termen entire, gently curved; whitish green, whitish outside the median band; numerous sinuous yellow-green lines (general effect "light cross-green"), mostly fuscous-marked at costa and in part (chiefly the subbasal and those of median area) about the fold; subbasal somewhat projecting outward at SC–M; two between this and antemedian; antemedian double in front of cell, thence single; cell-spot moderate, green mixed with fuscous, close to 1st postmedian; postmedians with the usual curves, 2nd postmedian double from costa to M<sup>2</sup>, where the outer runs into the inner; a slenderer line (faint posteriorly) bisecting the pale outer band; green subterminal double anteriorly, marked with strong paired fuscous spots at R<sup>2</sup> and again at M<sup>2</sup>, a smaller one between R<sup>3</sup> and M<sup>1</sup>; a less sinuous line between subterminal and termen; terminal dots blackish.—*Hindwing* with termen rounded; in ♀ with C anastomosing nearly to end of cell, SC<sup>2</sup>–R<sup>1</sup> rather long-stalked, R<sup>3</sup>–M<sup>1</sup> just stalked; in ♂ with C approximated to SC, then anastomosing shortly with SC<sup>2</sup>, DC<sup>1</sup> long, oblique, R<sup>2</sup> wanting, M<sup>2</sup> wanting; abdominal region folded into an ear-like vesicle of about half the wing-length (*abnormis*-group of Hampson, *Faun. Ind. Moths* iii. 408); pale drab, whitest costally, in parts shading into ecru-drab or brownish drab (or even towards purple-drab).

Underside light drab, the forewing posteriorly and parts of the hindwing whiter.

1 ♂, 2 ♀ ♀, in good condition. Also known to me from 2 poor ♀ ♀ in the British Museum, (one labelled "E. coast"), the whereabouts of Dr. Andrews' third not known.

The species of this group—which, through a long-standing misidentification of Guenée's *hirudinata* (see *Nov. Zool.* xxxvi. 165), was regarded as *Sauris* sens. str. (Warr. passim; Prout, *Ins. Samoa* iii. 149)—show numerous variations in the details of venation and the size of the ♂ "vesicle", but are really very homogeneous; they include at least two which are very widely distributed—*abnormis* Moore (sens. lat.) from Ceylon to the Solomons and *eupitheciata* Snell. (sens. lat.) from Ceylon to the Louisiades—but there is no clear evidence that *pelagitis* is derived from either of them and in any case it is not a mere race.

## GEOMETRIDAE

### Subfam. Geometrinae.

#### \**Cleora alienaria fumipennis* Prout.

*Boarmia acaciaria* form *cornaria* Guen." Hmps., *Mon. Christmas Isl.* p. 70 (1900), (err. det.).

*Cleora alienaria fumipennis* Prout, *Nov. Zool.* xxxv. 70 (1929); *Bull. Hill Mus.* iii (3) 191 (1929) (Christmas Island).

14 ♂♂, 2 ♀♀, mostly in fine condition.

Although the essential characters of this interesting race are well shown throughout, the series shows a good range of variability both in coloration, in the breadth of the median area and even to some extent in the strength of the crenulation of the lines. The most striking aberration has the median area almost clear white except at costa and around the cell-mark. On the whole the size is larger than in the original series, one ♀ reaching 42 mm., though the other measures only 35. The walnut-brown shades of the proximal and distal areas are in several of the examples particularly clear and broad.

The distribution of the collective species is similar to that of *Sauris remodesaria*.

#### \**Ectropis (Ruttelerona) scotozonea* (Hmps.).

*Boarmia scotozonea* Hmps., *Mon. Christmas Island*, p. 71 (1900).

3 ♂♂, 1 ♀.

Hampson (l.c.) has correctly indicated the affinities of this species; it is evidently a representative of *cessaria* Walk., the type of *Ruttelerona* Swinh., and might probably be cited as *cessaria scotozonea*. For the rest, *cessaria* inhabits Ceylon, India, Malaysia and New Guinea.

#### \**Orsonoba clelia* (Cram.).

*Phalaena clelia* Cram., *Uitl. Kap.* iii. 172, 174, t. 288 B, C (1782) (Coromandel Coast).

1 ♀.

In adding Samoa to the known localities for this very widely distributed species, I have (*Ins. Samoa* iii. 163) a note as to the previously ascertained range—India and Ceylon to the Solomons; we are now able to add another insular locality.

#### *Syrrhodia vindex* sp. n.

"*Hyperythra lutea* Cram." Hmps., *Mon. Christmas Isl.*, p. 70 (1900), (err. det.).

♂, 32 mm.; ♀, 36–37 mm. Smaller than *campylogramma* Prout (1926), which it presumably represents. ♂, so far as



known, duller (a little darker than tawny olive, perhaps 16"j in Ridgway's scheme), the forewing except between median and postmedian, heavily dark-clouded (Natal brown to bone brown), ♀ dimorphic (? polymorphic), the two known examples respectively tawny olive and cinnamon, in each case with paler area between median and postmedian; median line strong, more strongly excurved than is usual in *campylogramma*; hindwing with corresponding coloration, median line in both sexes well developed; median and postmedian of underside strong, the postmedian slightly less strongly sinuous than in *campylogramma*.

1 ♂, 2 ♀ ♀ (Dr. C. W. Andrews)—the second ♂ mentioned by Hampson not received at the British Museum.

It may be added to the original description of *campylogramma* (Nov. Zool. xxxiii. 26) that a ♂ from Trettes (3,000 feet), E. Java, has recently been received by the Tring Museum and is a little smaller and more olivaceous tinged than *c. campylogramma*.

## On a small Collection of Butterflies from Christmas Island, Indian Ocean

By H. M. PENDLEBURY

The eleven species of butterflies mentioned below were taken by Mr. M. W. F. Tweedie on Christmas Island during August and September 1932.

Only nine species have been recorded previously from this locality (Butler, Monograph of Christmas Island, 1900, pp. 60–63), but two of these, *Melanitis determinata* Btlr., and *Hypolimnas misippus* L., are not represented in the present collection. It seems rather uncertain whether either can be regarded as residents: the latter is reported to have "appeared immediately after the north-easterly gales, so that there can be little doubt that it was blown over from Java". (Butler, *l.c.p.* 62).

In the following list there are four species to be added to the island fauna: *Appias paulina* Cr. (= *albina* Auctt.), possibly migrants; *Trepsichrois eleutho* Quoy, an unexpected discovery; *Hypolimnas anomala* Wall., a true resident; and *Zizeeria gaika* Trimen. This high proportion of new records is surprising when one considers what careful investigations have been carried out already in this restricted area.

## BUTTERFLIES

### Family PIERIDAE

#### ***Appias paulina micromalayana* Fruh.**

*Papilio paulina* Cramer, Pap. Exot., ii, 1777, p. 21.

*Appias albina micromalayana* Fruh., Fruhstorfer in Seitz, Macrolepid., ix, 1910, p. 154.

3 ♂♂, 8 ♀♀, including four forms of the latter: f. *punctata* Fruh. (4), f. *flava* Rober, (1), f. *citronella* Fruh. (1), and f. *albina* Bsdv. (1).

#### ***Eurema hecabe amplexa* (Btlr.).**

*Terias amplexa* Butler, Proc. Zool. Soc. Lond., 1887, p. 523, fig. 5;  
*id.* Monograph Christmas Id., 1900, p. 63.

*Terias moorei amplexa* Fruhstorfer in Seitz, Macrolepid., ix, 1910, p. 169.

*Eurema hecabe amplexa* Corbet and Pendlebury, Bull. Raffles Mus., Singapore, 7, December 1932, p. 158.

A fine series of 36 ♂♂, 4 ♀♀. The ♀♀ have a much wider dark marginal forewing border which is more of the *hecabe* pattern than the ♂♂, and on the underside of the forewing there is in the ♀ only a thin reddish-brown apical streak to vein 4.

### Family DANAIDAE

#### ***Danaida chrysippus* L. forma *petilia* (Stoll).**

*Papilio petilia* Stoll, Suppl. Cramer's Pap. Exot., 1787-91, pl. 28, fig. 3.

*Limnas petilia* Butler, Monograph Christmas Id., 1900, p. 60.

*Danaida chrysippus* f. *petilia* Fruhstorfer in Seitz, Macrolepid., ix, 1910, p. 194.

5 ♂♂, 13 ♀♀.

#### ***Trepsichrois climena macleari* (Btlr.).**

*Vadebra macleari* Butler, Proc. Zool. Soc. Lond., 1887, p. 522, fig. 1;  
Monograph Christmas Id., 1900, p. 61.

*Euploea climena macleari* Fruhstorfer in Seitz, Macrolepid., ix, 1910, p. 226.

20 ♂♂, 4 ♀♀.

#### ***Trepsichrois eleutho* (Quoy).**

Freycinet Voy., ? 1824, pl. 83.

*Euploea eleutho* Fruhstorfer in Seitz, Macrolepid., ix, 1910, p. 241.

The occurrence of this species on Christmas Island is of particular interest as it is regarded as an Australian Pacific species. The single ♂ example taken agrees well with the race *eleutheria* Fruh., from Teoen Id. (Fruhstorfer, l.c.). It seems advisable, however, to await comparative material before imposing a race name. This species may be a true resident

on the island as other examples were seen. 1 ♂, expanse 87 mm. August 28th 1932.

It would appear that *Trepsichrois* Hbn. must replace the better-known generic name *Euploea* F. of which the type is *similis* L., a common *Danaida*.

### Family NYMPHALIDAE

#### ***Precis villida villida* (F.).**

*Papilio villida* Fabricius, Mant. Ins., ii, 1787, p. 35.

*Junonia villida* Butler, Monograph Christmas Id., 1900, p. 62.

*Precis villida villida* Fruhstorfer in Seitz, Macrolepid., ix, 1912, p. 522.

9 ♂♂, 9 ♀♀. Rather variable in size and in the distinctness of the pattern on the underside of the wings. September 10th–13th 1932.

#### ***Hypolimnias antilope anomala* Wall.**

*Papilio antilope* Cramer, Pap. Exot., ii, 1777, p. 132.

*Hypolimnias anomala* Wallace, Trans. Ent. Soc. Lond., 1869, p. 285.

*Hypolimnias antilope anomala* Fruhstorfer in Seitz, Macrolepid., ix, 1912, p. 542.

This species seemed to be the commonest butterfly on the island at the time of Mr. Tweedie's visit, but it is not mentioned in the 'Monograph'; it may be seasonal, or a species of comparatively recent introduction. Six of the thirty-three specimens brought back were bred from the larvæ, and larvæ which were preserved in spirit agree well with Dr. Hagen's description. Those bred from the larvæ (which were gregarious) pupated on September 8/9th and emerged on the 19/20th.

#### ***Hypolimnias bolina listeri* Btlr.**

*Papilio bolina* Linnæus, Syst. Nat., (x), 1758, p. 479.

*Hypolimnias listeri* Butler, Proc. Zool. Soc. Lond., 1888, p. 542.

*Hypolimnias nerina*, var. *listeri* Butler, Monograph Christmas Id., 1900, p. 62.

*Hypolimnias bolina listeri* Fruhstorfer in Seitz, Macrolepid., ix, 1912, p. 550.

4 ♂♂, 8 ♀♀. August 28th–September 13th 1932. The specimens vary considerably in size: ♂♂, 64–84 mm; ♀♀, 73–100 mm.

#### ***Eriboea pyrrhus andrewsi* (Btlr.).**

*Charaxes andrewsi* Butler, Monograph Christmas Id., 1900, p. 61, pl. ix, fig. 8.

This appears to be merely a well-marked insular race of the widely spread *E. pyrrhus* (L.). This race though described and figured in 1900 is omitted from Seitz' Macrolepidoptera vol. ix. (1914).

## A NEW LONGICORN BEETLE

Three female specimens were collected (expanse 102–105 mm.) between August 25th and September 10th 1932, but they are rather tattered as they had to be secured with dust shot owing to the inaccessible nature of their resting places.

### Family LYCAENIDAE

#### *Zizeeria gaika* (Trimen).

*Zizera gaika* Trimen, Trans. Ent. Soc. Lond., 1862, p. 298. Seitz in Seitz Macrolepid., ix, 1924, p. 925.

*Zizeeria gaika* Evans, Identification of Indian Butterflies (Second Edition), 1932, p. 234.

Three examples of this widely distributed species were collected.

#### *Nacaduba* sp. ? *aluta* Drce.

The only *Nacaduba* reported so far from Christmas Island is *aluta*; the specimen before me though probably this species is too worn for positive identification.

## A New Longicorn (Lamiidae) from Christmas Island, Indian Ocean

By K. G. BLAIR

#### *Phelipara subvittata* sp. n.

Elongate, sub-cylindrical, dark brown, clothed with moderately dense but evenly disposed fulvous and orange fulvous pubescence, the latter forming continuous lines running from the near border of the eye down to the jaw and again behind the eyes. Also an anterior and basal fringe on the thorax and more or less regular lines on the elytra, viz., one narrow sutural, two discal and a broader sublateral on each. Abdomen with dense orange clothing, leaving a tri-lobed bare space along the posterior edge of each of the first four segments. Antennæ half as long again as body, 12-jointed, the first six joints with a fringe of long blackened hairs beneath; length 17 mm.

Resembles the description of *P. vittata* Auriv., but this has the suture and five stripes on each elytron of paler pubescence instead of darker and the abdomen with irregular lateral spots and white pubescence.

*Type*.—Collected by M. W. F. Tweedie on Christmas Island, Indian Ocean, September 1932. In coll. British Museum.

## Some Insects from Christmas Island, Indian Ocean

*Note.*—A general collection of insects was made on Christmas Island, Indian Ocean in August and September 1932. The Geometers and Butterflies form the subjects of separate papers (*antea* pp. 88 and 94).

With the exception, perhaps, of the Rhopalocera, it cannot be said to be really representative for any of the Orders. The reason for this is partly that time was not available for intensive entomological work, and partly because the season was unfavourable. A lamp exposed at night attracted very little beyond a few beetles and an occasional moth. On the other hand I was told that during the wet season, December to May, the number and variety of insects attracted to light is enormous.

The present bare list is offered as a small contribution to our knowledge of the fauna of the island. No attempt has been made to collate it with the accounts of the insect groups published in Andrews' "Monograph of Christmas Island" and elsewhere.

The following specialists have very kindly given assistance in the identifications.—

Sir Guy A. K. Marshall, C.M.G., F.R.S. (*Curculionidae*); Messrs. K. G. Blair, G. E. Bryant and H. E. Andrewes (*Coleoptera*); Dr. R. Hanitsch (*Blattidae*); Dr. F. Santschi (*Formicidae*); and Dr. Nathan Banks (*Hemerobiidae*).

Mr. H. M. Pendlebury kindly identified as much of the material as could be determined from the collections and literature available in the Selangor Museum, Kuala Lumpur. *M. W. F. Tweedie*.

### ORTHOPTERA

**Blattidæ.** *Panesthia ruficeps* Kirb. (a local race of *P. javanica* Serv.), *Supella supellectilium* (Serv.), *Leucophaea surinamensis* (L.), *Periplaneta americana* (L.), *Blatta andrewsi* Hanitsch.

**Mantidæ.** *Heirodula dispar* Kirb. (very like *H. bipapilla* Serv. and at most a local race of it).

**Phasmidæ.** Immature specimens found only, probably *Clitumnus stilpnoides* Kirb.

**Gryllacridæ.** *Gryllacris rufovaria* Kirb.; also two immature specimens (♂ and ♀) probably of the same species as the larval forms described by Kirby from the island.

**Tettigonidæ.** *Psyras pomona* Kirb., *Xiphidion maculatum* Guill., *Pseudorhyncus lessoni* Serv.

**Acridiidæ.** *Valanga nigricornis disparilis* (Kirb.), *Catantops orientalis* (Kirb.), *Locusta migratorioides* Reh. and Frm.

**HYMENOPTERA ACULEATA**

**Eumenidæ.** *Odynerus polyphemus* Kirb.

**Vespidæ.** *Polistes balder* Kirb.

**Apidæ.** *Megachile rotundipennis* Kirb., *Megachile nivescens* Kirb.

**Formicidæ.** *Odontomachus haematodes* L., *Solenopsis (Solenopsis) geminata rufa* Jerd., *Paratrechina longicornis* Latr.

**NEUROPTERA**

**Chrysopidæ.** *Chrysopa esakii* Petersen.

**ISOPTERA**

**Termitidæ.** *Eutermes* sp.

**COLEOPTERA**

**Passalidæ.** *Leptaulax timoriensis* Percheron.

**Lucanidæ.** *Paraegus listeri* Gahan.

**Carabidæ.** *Stenolophus* sp.

**Coccinellidæ.** *Chilomenes sexmaculata* F., *Neda 16-notata* F., *Epilachna indica* Muls.

**Cleridæ.** *Dasyceroclerus* sp.

**Eucnemidæ.** *Galba wallacei* Perr.

**Buprestidæ.** *Chrysodema simplex* Waterh.

**Tenebrionidæ.** *Toxicum antilope* Arr., *Opatrum dubium* Arr., *Setenis carbonaria* Arr., *Bradymerus seminitidus* Arr.

**Mordellidæ.** *Glipa tricolor* Wied.

**Oedemeridæ.** "*Sessinia andrewsi*" Arr. (This species has been shown to be composite, and the material has not yet been critically examined); *Sessinia listeri* Arr.

**Eumolpidæ.** *Rhyparida modesta* Gahan.

**Cerambycidæ.** *Ceresium quadrimaculatum* Gahan, *Ceresium nigrum* Gahan, *Examnes affinis* Gahan.

**Prionidæ.** *Prinobius coxalis* Gahan.

**Lamiidæ.** *Monohammus nativitatis* Gahan, *Olenocamptus basalis* Gahan, *Pterolophia perplexa* (Gahan), *Prosoplus banksi* F., *Phelipara subvittata* Blair.

**Curculionidæ.** *Rhabdocnemis fausti* Gahan, *Camptorrhinus crinipes* Gahan.

**LEPIDOPTERA HETEROCERA**

**Sphingidæ**

*Cephonodes picus* Cr. 3 ex. *Chromis erotus* Cr. 2 ex. *Hippotion velox* F. 5 ex.

**Lymantriidæ**

*Porthesia pulvereae* Hmps. 10 ex.

## Arctiidae

*Utetheisa lotrix* Cr. 11 ex.

## Noctuidæ

*Amyna octo* Guen. 1 ex. *Amyna punctum* F. 5 ex. *Amyna crocosticta* Hmps. 2 ex. *Earias latimargo* Hmps. 1 ex. *Perigea capensis* Guen. 2 ex. *Lithacodia griseomixta* Hmps. 3 ex. *Eriopus* sp. 2 ex. *Cosmophila erosa* Hbn. 1 ex. *Cosmophila vitiensis* Btlr. 5 ex. *Ophiusa janata* L. 1 ex. *Ophiusa honesta* Hbn. 1 ex. *Ophiusa coronata* F. 1 ex. *Oxyodes scrobiculata* F. 1 ex. *Mocis frugalis* F. 11 ex. *Ophideres fullonica* L. 1 ex. *Gesonina* sp. 2 ex. *Plusiopalpa chalcytes* Esp. Sch. 1 ex. *Plusiopalpa orichalcea* F. 1 ex. *Hypena indicatalis* Wlk. 2 ex. *Hypena strigatus* F. 2 ex. *Bocula limbata* Btlr. 11 ex.

Two further species of *Hypeninae* are left undetermined.

## Epiplemidæ

*Epiplema inhians* Warr. 1 ex.

## Pyralidæ

*Cirrhochrista* sp. nr. *annulifera* Hmps. 1 ex. *Euzophera* sp. *Endotricha listeri* Btlr. 6 ex. *Sufetula sunidesalis* Wlk. 1 ex. *Zinckenia fascialis* Cr. 6 ex. *Zinckenia nigerrimalis* Hmps. 8 ex. *Eurrhynchos tricoloralis* Zell. 3 ex. *Ercta ornatalis* Dup. 3 ex. *Marasmia* sp. 4 ex. *Dichocrocis puntiferalis* Guen. 4 ex. *Dichocrocis auritincta* Btlr. 7 ex. *Glyphodes holophaealis* Hmps. 6 ex. *Glyphodes negatalis* Wlk. 1 ex. *Glyphodes suralis* Led. 2 ex. *Glyphodes indica* Saund. 2 ex. *Epipagis cancellalis* Zell. 1 ex. *Terastia meticulosalis* Guen. 2 ex. *Psara licarsisalis* Wlk. 7 ex.

## DIPTERA

**Culicidæ.** Collection not yet identified.

**Bombyliidæ.** *Argyramoeba distigma* Wied. var.

**Asilidæ.** *Promachus* sp., *Laphria nigrocaerulea* Kirb.

**Syrphidæ.** *Xylota* sp., *Syrphus* 2 spp.

## HEMIPTERA HETEROPTERA

**Aradidæ.** *Brachyrhynchus lignicolus* Kirb.

## HEMIPTERA HOMOPTERA

**Cicadidæ.** *Platypleura calypso* (Kirb.).

**Ricaniidæ.** *Ricania flavifrontalis* Kirb., *Varcia hyalina* (Kirb.).

**Cercopidæ.** *Clovina eximia* Kirb.

**Issidæ.** ? *Issus* sp.







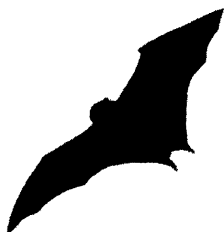
1



2



3



4



5



6

*Frigate Birds and Flying Foxes in flight.*

NOTE ON PLATE IV

Figs. 1, 2 and 3 are frigate-birds photographed soaring overhead.

Figs. 4, 5 and 6 are of the indigenous fruit-bat (*Pteropus natalis* Thos.).

In Christmas Island the fruit bats are active during the day, even flying in the strong sunlight at noon. Advantage was taken of this fact to photograph them in flight. A favourable situation was found at the top of a cliff about two miles north of Ross Hill. Fruit-trees in bearing were growing at the base of the cliff, and their highest branches reached a level a little below the top. The bats were continually flying round and settling in the trees to feed on the fruit. Fig. 4 shows one soaring with outstretched wings nearly overhead. Fig. 5 shows an individual swooping from behind the cliff-top to the tops of the trees, with the intention of alighting, the photograph being taken when it was almost immediately overhead. As can be seen the thumbs are extended forwards; the wings are partly folded so that the posterior margins are loose, and vibrate with a loud fluttering noise like a flag flying in a strong breeze. Fig. 6 shows a bat that has just checked in its flight preparatory to settling in the top of a tree; it is a little below the level of the observer. At first sight the fact that the thumbs appear below the lower edge of the wing in the photograph make it appear that the anterior margin of the wing has been depressed instead of thrown up as is the rule with animals checking their flight. Probably the truth is that the lower edge in the photograph is actually the posterior margin, the thumbs, when depressed to their full length, being long enough to overlap the wing and appear beyond it.

M. W. F. TWEEDIE.

## Notes on some Reptiles from the Malay Peninsula

by G. HOPE SWORDER

### *Draco* spp.

In spite of intensive collecting, especially in Perak and Negri Sembilan, I have only obtained examples of four species—*melanopogon*, *volans*, *formosus*, and *quinquefasciatus*.

These are common in the Peninsula in the order named. *D. melanopogon* is commonest but only in primary forest, and *D. volans* is the only form common in the towns and open land.

Boulenger has stated of *D. melanopogon* that next to *D. volans* it is the commonest species in the Peninsula, and takes its place in jungle country. It is only recently, however, that this statement has been confirmed, although the collection of the

Raffles Museum contains numerous specimens from undisturbed jungle on neighbouring coastal islands.

I have taken *melanopogon*, *formosus*, and *quinquefasciatus* in rubber adjoining virgin jungle, but have noted that their feet and patagia become clogged with dried latex, considerably hampering movement. *D. volans* seems to be able to avoid this, a fact which may be due to its more upright habit developed as a result of life in the open.

A Malay who saw me collecting *D. volans* volunteered the information that he had once seen an individual scratching in the earth at the foot of a rubber tree—apparently burying something. He investigated and dug up two eggs buried about an inch below the surface. The creature, he said, was so loth to leave the spot that he had to push it on one side.

### **Aphaniotis fusca.**

This species is very common at Gemas, Negri Sembilan, but I have tried for it time after time in other localities without success, especially in Perak. The only two specimens taken by me in Perak were obtained by chance; one being the specimen referred to in my paper on this species<sup>1</sup> and the other a specimen taken in 1932 at Bukit Berapit, between Taiping and Kuala Kangsar. This was a rather small male. The hind limb exceeded the snout only by 2 mm., and the irides were brown reticulated with gold, not blue as I should have expected. Is it possible that the blue irides and the greater length of hind limb are characters which only develop with full maturity.

### **Gonycephalus grandis.**

I collected a male at Sok, Kedah in 1930.

### **Calotes spp.**

*C. versicolor* is the common species near Alor Star, Kedah. The absence of this species from the south of the Peninsula probably signifies that it is a northern species in process of spreading. This pale lizard is most abundant in areas in which the soil is sandy and this factor may influence its distribution.

*C. emma* also appears to be confined to the north of the Peninsula, extending as far south as the mouth of the Perak River and Pulau Rumbia. It was very common at Kampong Menora on the Perak River about five miles south of Kuala Kangsar.

### **Liolepis belliana.**

Common in the sandy areas east and south of Alor Star, Kedah, where several specimens now in the Raffles Museum were collected by me. I noted that they had been eating the blossoms of a small shrub (*Melastoma* sp.).

1. Journ. Mal. Br. Roy. Asiat. Soc., VII, 1929, p. 327.

**Mabuya spp.**

*Mabuya macularia* is common in long grass on the race-course at Taiping, Perak. It is very active and hard to catch. Six specimens collected there are in the Raffles Museum. They are all small and I never saw one approaching the measurements indicated in the literature of the species. It does not appear to have been recorded south of Taiping, Perak.

*Mabuya multifasciata*.—I have taken a specimen which disgorged a centipede (*Scolopendra* sp.) longer than its own head and body.

*Mabuya rugifera*.—Four specimens collected in Perak are in the Raffles Museum. Two had the head washed with orange. The ventral surface of the body was, in all four, pinkish, not orange-red.

**Lygosoma spp.**

*Lygosoma herberti*.—One male from Kampong Menora, Perak, is in the Raffles Museum. Scale rows 28. Length of head and body 66 mm.; tail 55 mm. (tip regrown). This is the first recorded from the Peninsula proper; it was previously known only from Peninsular Siam.

*Lygosoma vittigerum*.—That this skink is by no means uncommon (Smith, Bull. Raff. Mus., 3, 1930, p. 36) is demonstrated both by the material now in the Raffles Museum and by my own observation. It is often to be seen, but runs up a tree immediately on being disturbed.

*Lygosoma larutense*.—One specimen of the smaller variety (*vide* Smedley, Bull. Raff. Mus., 6, 1931, p. 112) was collected by Major W. A. D. Edwardes at Bukit T'Kabeh, Kedah, 800 feet. It was olive-brown above and yellowish below. Scale rows 24. Text-figs. pp. 104 and 105.

A specimen from Cameron Highlands, Pahang 4,500 feet (coll. Wilkins) is the larger, spotted and striped variety. Scale rows 29.

**Agkistrodon rhodostoma.**

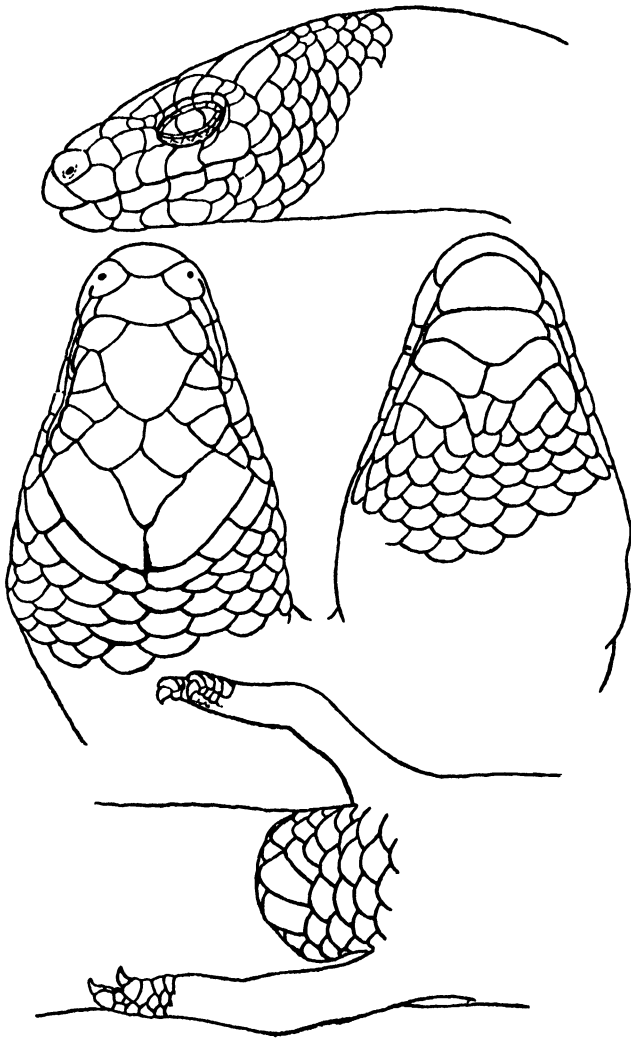
This snake is common near Alor Star, Kedah, as it is in almost the same latitude on the east coast of the Peninsula at Bangnara, Patani (Smith, Bull. R. M., 3, 1930, p. 89), which is only about 20 miles further north than Alor Star.

These two localities define the southern extremity of its known range in the Peninsula. There is a marked change of climate between Alor Star (north Kedah) and north-western Perak, which may account for the non-appearance of this species in the latter locality; but there is no apparent reason why it should not be found in south Kedah and Province Wellesley. I have seen no records of what this snake eats, but it is associated at Alor Star with *Liolepis belliana* which requires

sandy soil for its burrows. It is pure conjecture that there is any connection between the two species, but some such simple ecological relation is probably the cause of the break in the distribution of this snake.

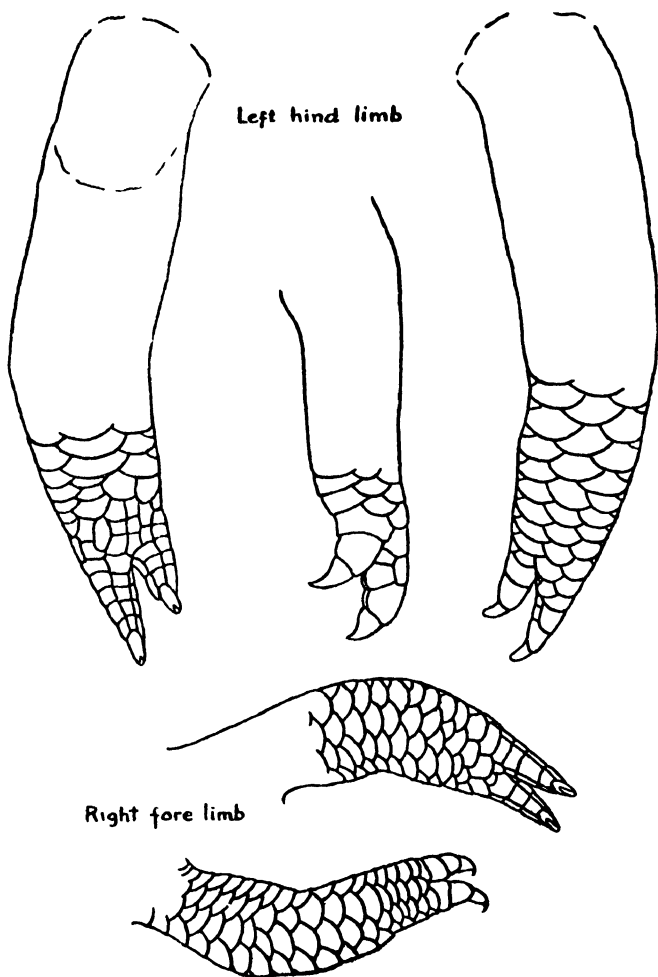
**Bungarus candidus.**

A female (now in Raffles Museum) was taken at Alor Star, Kedah.



*Lygosoma larutense*. Bukit T'Kabeh, Kedah, 800 feet.

NOTES ON SOME REPTILES FROM THE MALAY PENINSULA



*Lygosoma larutense*. Bukit T'Kabah, Kedah, 800 feet.

## A New Pedipalp from Mt. Kinabalu, North Borneo, 13,455 ft

by E. A. M. SPEIJER

(Plate V)

Messrs. F. N. Chasen and H. M. Pendlebury, collected only one Pedipalp on Mount Kinabalu, during their expedition of 1929 which was sent to me for determination but among other material sent from the Raffles Museum, were two other Pedipalps from Mount Kinabalu collected by Dr. R. Hanitsch in 1899.

The specimen of 4th May 1929 was obtained at Kenokok (3,300 feet), belonging to the lower mountain zone.

Mr. F. N. Chasen, in the introduction to "The Herpetology of Mount Kinabalu, North Borneo, 13,455 feet" by Malcolm A. Smith,<sup>1</sup> suggests zoological divisions for Mount Kinabalu and characterizes the lower mountain zone as follows:—

"From 3,000 to 6,000 feet. The zone of the high forest in which lowland species occur sporadically. Certain species of a peculiar sub-montane habitat are also characteristic of this division. Animals are abundant."

Having only one specimen, (there is no exact locality attached to the two specimens collected by Dr. Hanitsch) of a new species from this zone, it is of course not possible to conclude if it is a lowland form or not. Mr. F. N. Chasen characterizes the collecting place Kenokok as follows:—

"An excellent collecting ground situated in very high old forest. The camp was in the Kenokok valley on the right bank of the stream which eventually joins the Kinataki River."

The three specimens from Mount Kinabalu belong to the same, till now unknown species, which I call *Thelyphonus* Latr., em. Poc. *kinabaluensis* nov. spec. The genus Latr., em. Poc. is not at all homogenic and it highly needs a revision, which I hope to give shortly in another place. This genus can be divided into two groups, the females of the first group having modified tarsal joints of the antenniform legs, while the females of the second group have those tarsal joints not modified.

*Thelyphonus* Latr., em. Poc. *kinabaluensis* nov. spec. belongs to the first group.

This group with modified tarsal joints of the antenniform legs can be divided into two smaller groups, the females of the first group having those joints bayonet-shaped, and the females of the second group having several of the modified joints ridged, and black in colour. *Thelyphonus* Latr., em. Poc. *kinabaluensis*

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1. Bull. Raffles Mus., 15, 1931.

# A NEW PEDIPALP FROM MT. KINABALU

nov. spec. belongs to the second group, but differs from almost all other species belonging to this group, namely:—

<i>Thelyphonus</i> Latr., em. Poc. <i>caudatus</i> (L.).				
"	"	"	"	<i>borneensis</i> Krpln.
"	"	"	"	<i>klugi</i> Krpln.
"	"	"	"	<i>celebensis</i> Krpln.
"	"	"	"	<i>sucki</i> Krpln.
"	"	"	"	<i>semperi</i> Krpln.
"	"	"	"	<i>doriae</i> Thor.
"	"	"	"	<i>schimkewitschi</i> Tarnani.
"	"	"	"	<i>linganus</i> C. L. Koch.
"	"	"	"	<i>burchardi</i> Krpln.
"	"	"	"	<i>wayi</i> Poc.
"	"	"	"	<i>kraepelini</i> E. A. M. Speijer.

The females of these species never have a modified 5th joint, but they have often several of the following tarsal joints modified:—the 6th, 7th, 8th and 9th.

*Thelyphonus* Latr., em Poc. *kinabaluensis* nov. spec. shows modified 5th and 6th joints.

Only *Thelyphonus* Latr., em. Poc. *anthracinus* Poc. has also somewhat modified 5th and 6th tarsal joints.

But this species, which also occurs in Borneo (Sarawak), differs from *Thelyphonus* Latr., em. Poc. *kinabaluensis* nov. spec. among other characters by having a different proportion of the joints of the antenniform legs and quite different ommatoids, etc.

Here follows a summary of all the species of *Thelyphonus* Latr., em. Poc. found in Borneo:—

<i>Thelyphonus</i> Latr., em. Poc. <i>caudatus</i> (L.).				
"	"	"	"	<i>doriae</i> Thor.
"	"	"	"	<i>anthracinus</i> Poc.
"	"	"	"	<i>sucki</i> Krpln.
"	"	"	"	<i>borneensis</i> Krpln.
"	"	"	"	<i>grandis</i> E. A. M. Speijer.
"	"	"	"	<i>kinabaluensis</i> nov. spec.

***Thelyphonus* Latr., em. Poc. *kinabaluensis* nov. spec.**

*Colour*: upperside of trunk blackish brown, lower side reddish brown; legs and postabdomen of a lighter colour.

*Abdomen*: ♀ *first sternal plate*. The middle of it smooth and convex, + heart-shaped, lighter coloured than the rest of the plate. Two elongate-oval depressions.

♂ *first sternal plate* with a strong median groove, caudal widening up into a triangle with a very obtuse top angle.

Following sternal plate showing the usual median tubercle.

*Ommatoids*: not large, oblong-oval, + their own diameter removed.



*Palpus maxillaris*: rather coarsely granulated.

*trochanter* dorsally armed with six spines, the fourth from the middle being by far the greatest.

*tibial apophysis* with many spines.

*tarsal joints of antenniform leg*:—

♂	♀
1. very small, much longer than broad	1. the same as in ♂.
2. much larger, longer than all following joints except 9.	2. the same as in ♂.
3. except 1 and 8, the smallest joint.	3. smaller as in ♂.
4. }	4. the same as in ♂.
5. } + of the same length, longer than broad	5. { modified, with a
6. }	6. { deep groove,
	6. { both longer
	6. { than broad.
7. somewhat shorter than one of the three former ones	7. the same as in ♂.
8. somewhat longer than 2.	8. the same as in ♂.
9. + as long as 2 + 3.	9. the same as in ♂.

♀ *holotype*: length 24 mm., with palpus maxillaris 30 mm.

*Locality*: Kenokok; 3,800 feet; Mount Kinabalu; Borneo.

♂ *allotype*: length 22 mm., with palpes maxillaris 25.5 mm.

*Locality*: Mount Kinabalu, Borneo.

♀ *paratype*: a rather damaged ♀, length 22 mm., with palpes maxillaris 26 mm.

The types are in the collection of "s Rijks Museum van Natuurlijke Historie", Leiden, Holland.

#### EXPLANATION OF PLATE V

*Thelyphonus* Latr. em. Poc. *kinabaluensis* nov. spec.

Fig. 1. male, dorsal view, × 2.

Fig. 2. male, palpus maxillaris.

Fig. 3. male, genital sternum.

Fig. 4. male, tarsus of antenniform leg.

Fig. 5. female, dorsal view, × 2.

Fig. 6. female trochanter of palpus maxillaris

Fig. 7. female, genital sternum.

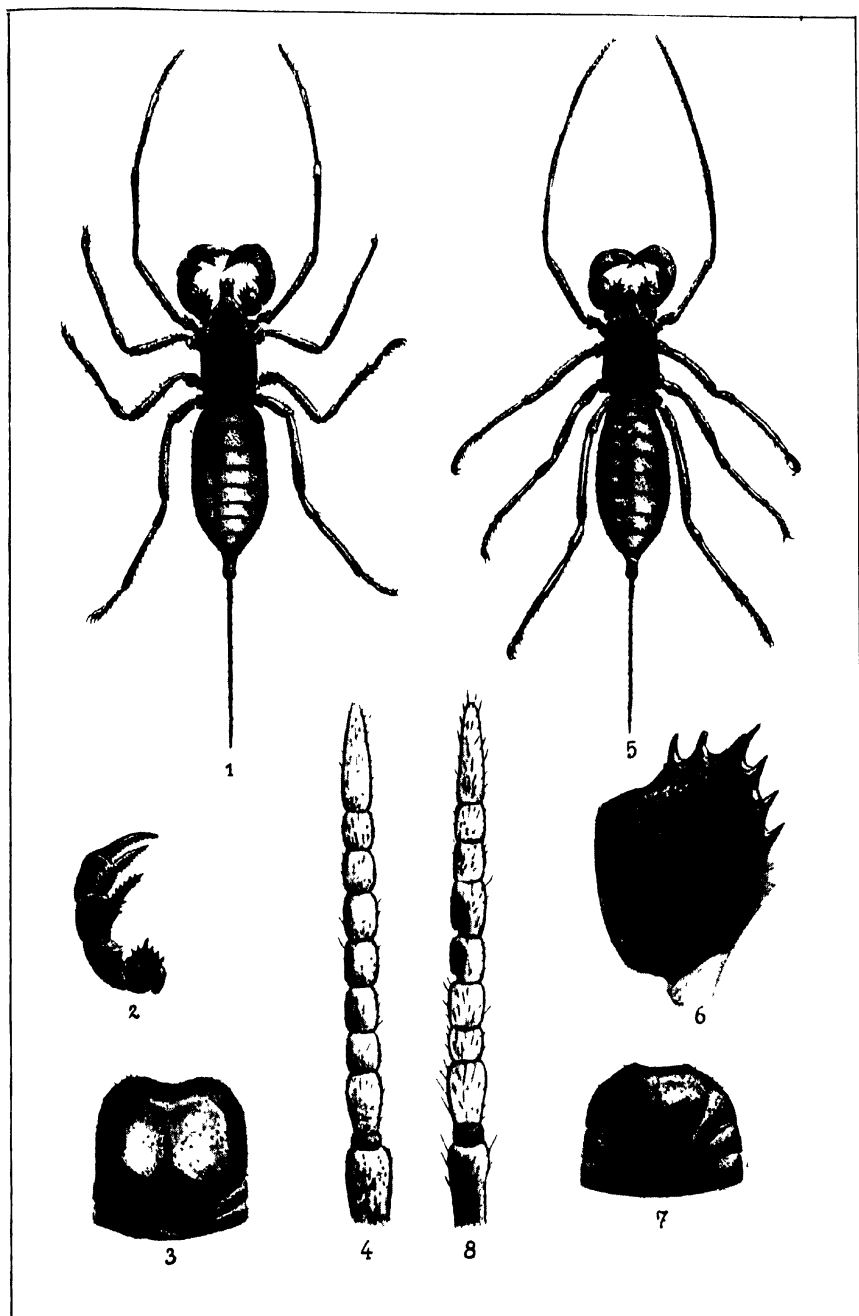
Fig. 8. female, tarsus of antenniform leg.

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## Planaires Terrestres du Raffles Museum

par P. DE BEAUCHAMP, professeur à la Faculté des  
Sciences de Strasbourg

(Plate VI)

La petite collection qui m'a été confiée provient, en dehors de deux espèces du North-Borneo, de diverses stations éparpillées de Singapore au Siam. Nos connaissances sur les Triclades terrestres de cette région, sont encore fort restreintes, par opposition au grand nombre de formes, d'ailleurs très différentes, qui sont connues de l'Inde d'une part, des îles de la Sonde d'autre part: la monographie de von Graff (1899) indique neuf espèces de Singapore (la plupart répandues ailleurs), une de Malacca et une du Siam. J. Müller (1902) et Laidlaw (1903) ont ajouté respectivement deux et une espèce pour la Péninsule malaise, Kaburaki (1920) a signalé du Siam une forme largement répandue. Quant à l'ignorance encore plus grande où nous sommes concernant l'Indo-Chine française, elle sera bientôt dissipée par les récoltes de Mr. C. Dawydoff dont j'ai déjà reçu un lot important et du plus grand intérêt.

Le matériel qui m'a été remis était bien conservé, l'alcool assurant en général une fixation suffisante pour ces animaux. J'appellerai seulement l'attention sur l'utilité de combattre leur tendance naturelle à se recourber et s'entortiller sous son action. Si la chose est possible, il est bon, aussitôt morts, de les redresser

avec précaution et de les maintenir droits quelques heures, jusqu'à durcissement complet, puis de les introduire dans des tubes étroits. Les tasser dans le fond d'un tube large en les comprimant avec du coton augmente au contraire le mal et rend très difficile aussi bien l'étude anatomique que l'étude extérieure. De plus les échantillons ne sont pas montrables dans un Musée.

Je renvoie à mes travaux antérieurs pour les conventions adoptées dans les descriptions, et les discussions sur l'état actuel de la systématique et la valeur des caractères. Les divergences paradoxales entre ceux de l'ornementation extérieure et ceux de l'appareil copulateur se reproduiront dans le présent matériel.

## TRICLADES TERRICOLES

### Famille Bipaliidæ

#### Genre *Bipalium* Stimpson

#### *Bipalium haberlandti* Graff

Singapore, 2.	4.	1932, sur Gingembre, Le Doux.	—2 exemplaires, sexués
„ 13.	4.	„ „ „	2 exemplaires, sexués
„ 19.	4.	„ „ „	2 l'un sans tête, l'autre non sexué
„ 22.	4.	„ „ „	2 l'un sexué et incomplet

Tous les exemplaires sont semblables, de grande taille: 140 à 85 mm. de long sur 8 à 10 de large, la tête débordante, falciforme, à oreillettes recourbées; ils sont très plats. La teinte générale est gris verdâtre avec une ébauche plus ou moins nette de fine raie médiane jaunâtre et de taches claires sur la tête en dedans des oreillettes. La sole fait à la face ventrale  $\frac{1}{5}$  de la largeur. Tout ceci correspond bien à la description de *B. haberlandti* par Graff (voir sa pl. X, fig. 18–22), mais il y a plusieurs espèces de même apparence. L'étude de l'appareil copulateur confirme l'attribution.

Sa topographie générale est en effet bien semblable à celle indiquée dans le texte de Graff, fig. 60, p. 212, sauf que l'atrium commun est notablement plus étroit et le coussinet où s'ouvrent côte à côte les deux conduits en conséquence très réduit. Dans le détail histologique, l'individu du 22.IV qui a été coupé montre des différences assez nombreuses, toutes dans le sens d'une simplification de la musculature. Je ne vois pas à proprement parler de musculature commune à la partie ♂ et à la partie ♀; l'atrium n'est entouré que d'un plexus assez lâche et la disposition compliquée des fibres décrite minutieusement par Graff (pl. XL, 7 et XLI, 1–3) dans l'organe ♂ ne peut être retrouvée. Il y a simplement un bulbe formé surtout de fibres en coupole irrégulières et peu serrées qui se prolongent dans la partie libre, mêlées de radiaires et de circulaires; à la périphérie seulement il paraît y avoir une condensation des longitudinales.

L'épithélium du canal éjaculateur, où les canaux déférents aboutissent par un tronc commun mince traversant le bulbe, est formé de grosses cellules qui oblitèrent complètement sa cavité en haut, s'écartent plus bas et deviennent minces dans l'extrémité où disparaissent les boules basophiles qui les remplissent en même temps que de petits grains roses (par l'hémalum-éosine). Ces derniers au moins proviennent de glandes traversant la musculature. L'atrium ♂ a un épithélium cilié, très plat en haut, chargé de sécrétion bleue en bas. L'ootype, dont Graff n'a rien dit, a des glandes rouges et des bleues plus minces traversant un bulbe lâche et une couche interne formée surtout de conjonctif un peu basophile avec des fibrilles circulaires. L'épithélium est plissé et traversé dorsalement par un très court conduit commun aux deux oviductes.

Un autre individu, du 19.IV., montre déjà une musculature plus développée, les fibres circulaires dans le pénis libre remplissent la plus grande partie de la section, mais leur disposition en blocs n'est pas nette comme dans la description de Graff; il existe aussi une gaine musculaire, en plexus fin, autour de l'extrémité de l'atrium ♂ et des fibres communes aux deux appareils; la couche circulaire interne de l'ootype est très forte. Comme il est fréquent chez les Tricladés de rencontrer des degrés de développement très différents de la musculature des divers appareils suivant l'état fonctionnel et le degré de maturité, et qu'ils peuvent aussi caractériser des races locales comme je l'ai montré chez les Paludicoles, il n'est pas douteux qu'il ne s'agisse bien de la même espèce.

Celle-ci, décrite de Java où elle ne semble pas fréquente, n'avait jamais été signalée à Singapour où l'on a souvent récolté des Planaires et paraît y être devenue abondante.

**Bipalium admarginatum** nov. sp.

Sedagong, 1000 pieds, Ile Tioman, mer de Chine, V.1927, N. Smedley.—2 exemplaires.

Cette curieuse espèce pourrait d'après l'appareil copulateur être fusionnée à une forme bien connue, *B. marginatum* Loman, avec de petites différences qui n'excèdent guère celles que nous venons de trouver entre nos *B. haberlandti* et leur type. L'aspect extérieur au contraire s'en écarte à tel point qu'il paraît impossible de les rapporter à un même cycle spécifique.

Les deux individus sont semblables et mesurent 85 et 90 mm. de long sur 3 de large, forme par conséquent très grêle; la tête n'excède pas la largeur du corps, elle est arrondie ou plutôt subogivale, les oreillettes non saillantes. (pl. fig. 1). La teinte générale est brun assez clair (pigment épidermique comme d'habitude) avec une bande noire (pigment du parenchyme) au bord de la tête et trois autres plus larges, à bords un peu ondulés, audessous (dont les deux premières se prolongent ventralement

jusqu'à la sole). Plus bas l'ornementation passe du type transversal au type longitudinal: deux raies marginales minces partent de la dernière bande tandis qu'une médiane beaucoup plus large naît un peu plus bas, les trois vont jusqu'au bout du corps. La face ventrale montre une sole occupant  $1/4$  de sa largeur et présentant elle-même un tiers médian blanc et des latéraux grisâtres. Les yeux sont répandus sur le bord de la tête avec une tache auriculaire formée d'yeux plus gros, mais peu serrés. (texte fig. 1A).

Or *B. marginatum*, dont j'ai eu entre les mains plusieurs variétés provenant de Java (de B. 1929 et 1930a) est une espèce de grande taille aussi, mais large, avec une tête semi-circulaire très débordante (voir Graff pl. XII, 1-4, et XIX, 21-22). Son ornementation comprend bien en principe trois raies longitudinales plus ou moins distinctes (qui peuvent même s'effacer complètement, des mouchetures éparses subsistant seules); mais les marginales sont plus larges que la médiane et jamais de bandes transversales n'ont été signalées, les deux types paraissent jusqu'à présent s'exclure. . . . Toutefois la forme générale est plus importante que les variations de la pigmentation et paraît incompatible dans les deux formes.

L'appareil copulateur est chez notre forme beaucoup plus petit en dimensions absolues que chez *marginatum*: dans l'exemplaire de 85 mm., qui a sa bouche à 30 mm. du bout supérieur, le pore génital à 6 d'elle, sa longueur totale est de 3, tandis que dans un *marginatum* de l'expédition Thienemann (de B. 1930a) qui n'avait que 60 mm. elle atteint 6.5. La topographie est bien la même, (fig. 1b du texte) sauf que la partie ♂ paraît plus courte par rapport à la ♀. Le large coussin, incisé et à épithélium "eingesenkt" où débouchent les deux conduits (assez éloignés dans le sens transversal, le ♀ étant à gauche) est très caractéristique. Du côté ♂ il y a simplification de la musculature, qui renferme pourtant les mêmes couches: la longitudinale externe est moins épaisse et peu régulière. Surtout la circulaire, décomposée en segments très denses dans le type (Graff, pl. XLIII, 2), paraît ici surtout formée de tractus conjonctifs radiaires avec des fibres fines éparses à la périphérie (et sans doute en dedans, mais le conjonctif y est plus colorable). Une telle involution est connue: voir de B. 1930b pour *B. univittatum*, et ce que nous venons de dire de l'ootype chez les deux *B. haberlandti*. L'épithélium identique, papilleux et rose, donne à la lumière un aspect spongieux là où il est serré, et les glandes périphériques sont peu développées. La pointe du pénis est un cône très mince, imitant le pseudoflagellum de quelques Dendrocoelidés; il existe une musculature circulaire nette autour de l'atrium ♂ au moins en haut, un plexus diffus dans le

coussinet, de même qu'autour de l'ootype. L'abouchement des glandes coquillères sur l'épithélium plutôt basophile de celui-ci se voit assez mal. Les oviductes sont écartés à leur abouchement.

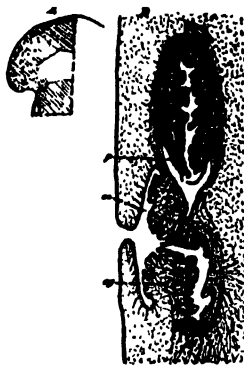


Fig. 1.—*Bipalium admarginatum*. A, répartition des yeux à la face dorsale de la tête. B, schéma de l'appareil copulateur.

Lettres employées dans toutes les figures: A a, atrium commun; cc, canal copulateur; cd, canaux déférents; ce, canal éjaculateur; og, ootype ou oviducte commun; p, pénis; u, bourse copulatrice; v, vagin.

### *Bipalium simrothi* Loman.

Synon.: *B. rauchi*, *ridleyi* et *steindachneri* Graff?

Sedagong, 1000 pieds, île Tioman, mer de Chine, Mai 1927, N. Smedley.—

Un exemplaire, sexué

Ile Aor, mer de Chine, 29. 4. 1927, N. Smedley.—Un non sexué

2 dont un sexué

" " 30. 4. " "

Cette espèce est très polymorphe, comme l'avait bien reconnu Graff, qui d'ailleurs avait vu avant description le type de Loman. Le spécimen de Sedagong mesure  $31 \times 5$  mm., la tête manque et la cicatrice subsistante indique qu'elle n'était pas très large. La sole fait  $1/4$  de la largeur, la bouche est à 15 mm. du bout supérieur, le pore génital à 5 d'elle. Sur le dos brun (avec de nombreuses excoriations laissant voir le parenchyme blanc) se détachent 5 bandes transversales noires qui sauf la première et la dernière se dédoublent latéralement, puis passent à la face ventrale plus claire et se refusionnent le long de la sole (pl. fig. 2 et 3) de sorte que chacun des trois systèmes figure une paire de besicles repliée le long des bords. Il existe de plus des anastomoses médianes sauf entre la 2<sup>e</sup> et la 3<sup>e</sup> bande, se prolongeant jusqu'à la pointe.

Les deux exemplaires d'Aor 30. Avril sont plus petits et surtout très trapus, sans doute par contraction à la fixation: 16 et 12



mm.  $\times$  6, la tête étant beaucoup plus large que longue. Le plus grand seul est sexué (bouche à 9 mm., pore génital à 3). Le brun de l'épiderme étant très foncé il est difficile de distinguer les bandes sans éclaircissement, et je soupçonne que *B. steindachneri* Graff (pl. VIII, 20-21) fondé sur un exemplaire de ce galbe provenant de Malacca, unicolore sauf les deux taches latérales claires de la tête, n'est pas autre chose que cette espèce. Le nôtre montre donc (pl. fig. 4) sur la tête une bande marginale épaissie aux extrémités et au milieu, sur le corps cinq bandes transversales de largeur croissante jusqu'à la 3°, la 4° au contraire très mince et interrompue au milieu, la 5° avec une grande échancrure inférieure. Enfin une petite tache au bout inférieur. On ne peut les suivre à la face ventrale, dont la sole prend 1/6. L'autre exemplaire (pl. fig. 5) est analogue sauf que la bande 3 est dédoublée, et interrompue sur la ligne médiane de même que la dernière.

Enfin l'individu du 29. Avril, non sexué, mesure 20  $\times$  4 mm. et montre avec une forme plus allongée une ornementation tout à fait analogue; il y a interruption médiane pour toutes les bandes. C'est le seul où l'on arrive à distinguer quelques yeux épars dans les espaces clairs de la tête.

L'analogie est évidente pour les trois derniers avec le *B. simrothi* de la figure 27 pl. IX de Graff, compte tenu de sa contraction plus faible. Or c'est celui qui a été coupé par J. Müller 1907 et possède l'appareil copulateur très caractéristique que nous allons redécrire. On retrouve sensiblement les mêmes traits, surtout l'échancrure de la dernière bande, chez *B. rauchi* Graff de Singapore (même planche fig. 36) que je suppose appartenir à la même espèce; pour *B. ridleyi* de même provenance (fig. 32-33) la chose est moins certaine. Au contraire, Müller a montré que l'individu de la fig. 31 (et sans doute celui de 29-30), qui ne montre pas cette échancrure constitue, bien que recueilli aux îles Natunas avec le type de *simrothi*, une espèce tout à fait différente qu'il a appelée *B. distinguendum*.

Je figure ici (texte, fig. 2) d'après l'exemplaire sexué d'Aor les particularités de l'appareil copulateur bien reconnues par cet auteur et que la réunion du canal copulateur, de l'ootype et de la bourse copulatrice dans un même niveau transversal (il a fallu les écarter longitudinalement sur le schéma) rend assez difficiles à débrouiller. Le pénis a un bulbe assez plat formé de couches musculaires en deux directions alternantes; il renferme une petite vésicule séminale ciliée, entourée d'une faible musculature circulaire, qui reçoit dans un petit diverticule ventral les deux canaux déférents très minces. La partie libre, longue et effilée, a, à la périphérie, de même que tout l'atrium  $\delta$ , une couche

très mince et très dense de muscles circulaires (M. paraît l'avoir confondue avec l'épithélium très plat qui la recouvre). En dedans, du parenchyme lâche, puis un canal éjaculateur très dilaté et revêtu d'un épithélium épais, infiltré de sécrétion, mieux conservé que dans l'individu de M. En haut il est très épais, plus bas il forme des bourrelets longitudinaux irréguliers, 7 ou 8 dans la partie terminale. Celle-ci prend l'éosine plus que l'autre les grains, qui proviennent au moins en partie des glandes périphériques, y étant plus denses; au milieu il y a un anneau rose plus pâle, sans grains. La pointe du pénis, effilée et déviée vers la droite, remplit juste le goulet de l'atrium ♂, qu'on peut qualifier de canal copulateur et au niveau duquel sa couche musculaire se dédouble en un sphincter bulbeux renfermant encore des glandes.



Fig. 2.—*Bipalium simrothi*, schéma de l'appareil copulateur; l'atrium ♂ l'oviducte et la bourse copulatrice, qui devraient à peu près se superposer en vue de profil, ont été écartés.

L'atrium commun ouvert au pore genital est très large, mais aplati dorso-ventralement et reçoit de nombreuses glandes bleues. Au fond il se bifurque en conservant d'abord le même caractère. La partie droite se dilate en un vestibule à parois minces où s'ouvre le canal copulateur; l'autre se continue par l'ootype, à peu près médian, légèrement dilaté au bout où aboutissent les deux oviductes dans un épaississement de l'épithélium cilié, et entouré de glandes coquillières très colorables. C'est sur le col formé par l'atrium que se branche celui de la bourse copulatrice située un peu plus à gauche. Elle est ronde et tapissée d'un épithélium rose cilié, mince au fond, épais et à plusieurs rangées de noyaux au milieu où il reçoit des glandes qui forment plexus autour d'une faible musculature circulaire.

L'individu de Sedagong forme sans doute une variété par l'appareil copulateur comme par l'ornementation. La topographie rappelle encore mieux la description de Müller mais le pénis est court et large, la vésicule séminale engagée dans sa base et entourée d'un plexus musculaire dense, l'orifice copulateur a un véritable bulbe avec fibres longitudinales internes et radiales en colonnettes au milieu des circulaires. Par contre l'utérus est plus petit et plus irrégulier de forme, les glandes bleues se mêlent aux roses sur toute sa surface.

*Bipalium everetti* Moseley var. *longitudinalis* nov.

Kenokok, N. Borneo, mont Kinabalu, 3300 pieds, 26.IV.1929, H.M.P. et F.N.C. un exemplaire.

J'ai fait en 1926 l'historique de cette espèce qui signalée très imparfaitement à Sarawak en 1870 n'a été décrite avec précision que dans mon travail sur les Planaires de cet état. L'exemplaire de Kenokok s'en rapproche par la taille (40 × 4, bouche à 18, pore génital à 8), la forme, et la gamme de coloration beaucoup plus éclatante que dans les autres espèces présentes; il s'en écarte par le type d'ornementation et à un moindre degré par quelques particularités de l'appareil copulateur. Si le tout est en corrélation, ce qu'il n'est pas possible d'affirmer sans un matériel beaucoup plus étendu, il y a lieu d'en faire une variété.

La teinte épidermique du dos, excoriée par places, est ici un beau rouge brique qui s'atténue au milieu en une fine ligne longitudinale jaune finissant au milieu de la tête. Au lieu de plusieurs paires de taches latérales noires, tendant à se fusionner en bandes transversales, comme dans les exemplaires de Sarawak, nous avons ici une bande mince, submarginale, de cette couleur, qui fait tout le tour du corps car elle se continue au niveau des oreillettes avec un large bandeau céphalique un peu échancré au milieu. La face ventrale et les côtés sont tout entiers d'un blanc crème où se détache à peine une sole atteignant 1/4 de la largeur. Les yeux, extrêmement serrés au niveau du bord frontal et de la tache collaire, qui se prolonge seule du côté ventral, s'éparpillent sur toute la tête sauf la base des oreillettes et en bandeau sur le cou; je n'avais pas vu ces derniers précédemment, sans doute en raison de la présence d'une bande noire à ce niveau.

L'appareil copulateur a bien le même plan et la même structure (de B. 1925 fig. 2D et 1926 fig. 3), les différences sont les suivantes: le pénis libre est plus long que le boudin musculaire du bulbe, il en atteint le double, et même plus en tenant compte de ce qu'il est oblique sur le plan sagittal, l'extrémité déviée à droite, il est aussi plus mince et plus effilé. L'enveloppe de muscles circulaires commune à tout l'appareil ♂ est régressée et prend une apparence purement conjonctive avec une réaction

faiblement basophile, comme dans les autres cas que nous venons de citer. Par contre la longitudinale est très dense surtout en bas; elle se termine dans le cône par lequel débouche l'atrium ♂ et qui est très développé, doublé d'un épithélium assez haut entouré de conjonctif et d'un sphincter, et renferme à son intérieur la pointe effilée du pénis. La papille sur laquelle débouche l'ootype est au contraire plus courte; de nombreuses glandes bleues débouchent entremêlées aux rouges jusqu'au fond de l'atrium commun.

***Bipalium fuscatum* Stimpson?**

Ile (Poulo-) Terutau, Siam, W. L. Abbott, 7 exemplaires.

Les animaux sont extrêmement pelotonnés et tortillés, le plus grand dépasse certainement 150 mm., un autre en meilleur état a  $115 \times 8$ , la tête est petite (2.5 de long sur 6 de large), elle est grisâtre de même que le ventre dont la sole fait le  $1/7$ , tandis que le dos est brun clair uniforme. Ces caractères peuvent s'appliquer à *B. fuscatum*, qui est répandu de l'Inde au Japon, mais l'absence d'organes génitaux ne permet pas une détermination précise.

***Bipalium* sp.**

Tanah-Rata, Cameron's Highlands, Péninsule malaise, 4500 pieds, sous pièce de bois dans la jungle, 27.V.1931, K.B.W., un exemplaire non sexué.

L'animal mesure 45 mm. (sans la queue qui manque) sur 4, avec une tête semicirculaire blanche, le reste étant gris de plomb, et un sole ayant  $1/3$  de la largeur, son tiers médian différencié.

**Famille RHYNCHODEMIDES**

**Genre *Cotyloplana* Spencer**

Je ne puis me résoudre à conserver la famille des *Cotyloplanidés* où Graff réunissait ce genre aux *Artiocotylus* aujourd'hui placés dans les *Rhynchodémidés*; pas plus que chez eux la présence d'une fossette adhésive céphalique dont le degré de différenciation est très variable et qui apparaît aussi dans les *Géoplanidés* chez certaines *Pelmatoplana* (voir de B. 1930 a et b) ne suffit à justifier la séparation et il faudrait même savoir si les espèces, peu connues anatomiquement et discontinues dans leur répartition (archipel de la Sonde et île Lord Howe) ne pourraient se grouper plus naturellement avec d'autres *Rhynchodémidés*. Celle que nous avons à décrire est en tous cas très particulière.

***Cotyloplana borneensis* nov. sp.**

Kamborangah, Mt. Kinabalu, North Borneo, 7200 pieds, 26.IV.1929, H.M.P. et F.N.C.

L'exemplaire unique mesure 19 mm. sur 2 avec la bouche à 10 et le pore génital à 3 d'elle, il est assez plat et effilé aux deux extrémités. Le dos brun montre des marbrures dûes à des excoriations et de très fines taches noires après éclaircissement. Ventre blanc dont la sole qui en fait 1/3 ne se distingue qu'à grand peine. L'extrémité supérieure (fig. du texte 3 A) se termine en une pointe obtuse à la base de laquelle se voient deux gros yeux avec une cupule pigmentaire mucronée et un cristallin bien distinct. La fossette se trouve au-dessus d'eux, c'est une dépression ovale où se termine la sole, après éclaircissement on distingue le tissu glandulaire qui la double. Elle paraît moins différenciée en ventouse que dans d'autres espèces, mais je n'en ai pas fait l'étude anatomique.

L'appareil génital (3 B) est très particulier par l'existence d'une vaste bourse copulatrice indépendante des voies ♀, placée en face du pore, entr'elles et l'organe ♂. Celui-ci se compose d'un long conduit sinueux, glandulaire, puis musculaire, qui débouche au fond d'un atrium conique sur une papille tronquée où fait juste saillie le méat. Les deux canaux déférents aboutissent dorsalement à l'origine de sa première section qui revient ventralement et forme un double coude, pas tout à fait sagittal d'ailleurs. Elle a une lumière assez spacieuse mais anfractueuse, dilatée même en vésicule au début (1) où l'épithélium est papilleux. Cet épithélium est, avec les tissus sous-jacents, complètement infiltré par la sécrétion des glandes qui l'entourent, en petits grains prenant fortement l'hématoxyline ferrique (2) surtout dans le second coude (3). La musculature est assez faible, surtout longitudinale irrégulière. Ensuite vient une zone de transition où elle devient plus nette en dedans du manchon glandulaire (4) et une dernière circonvolution où l'épithélium est plat quoiqu'infiltré des même petits grains et entouré d'une gaine de muscles circulaires (5). Le tout se poursuit dans la papille pénienne où le canal se dilate légèrement et où les muscles moins serrés se mélangent à des glandes peu colorables arrivant de la périphérie (6). Autour de ce manchon se trouvent plusieurs couches de fibres alternantes rappelant un bulbe ordinaire, mais qui s'éparpillent en haut et convergent en bas vers la pointe. L'épithélium de l'atrium paraît "ingesenkt" sur le pénis et les culs de sac, bas et cilié dans le reste, il est suivi des minces couches musculaires habituelles.

La bourse, faite d'un meilleur nom, est un gros organe ovale à lumière spacieuse et paroi plus épaisse en haut sur la ligne médiane; la lumière anfractueuse se réduit latéralement à une fente sagittale. Epithélium très basophile, relativement haut, bien cilié en bas, plus papilleux supérieurement. La masse musculaire est formée d'un plexus très serré en dedans, moins

en dehors où les fibres tendent à devenir circulaires et sont mêlées de petites glandes. Juste au-dessous de la bourse débouche une sorte de vagin à épithélium très élevé, cilié, entouré de muscles circulaires, puis longitudinaux, qui reçoit au fond un oviducte commun de structure typique et semblable à celle des oviductes pairs qui s'y réunissent. Glandes coquillières pas très serrées tout autour. L'épithélium d'un cæcum digestif voisin s'effile en pointe vers la bifurcation de l'oviducte et il est fort possible qu'il y ait une communication génito-intestinale dans d'autres individus.



Fig. 3.—*Cotyloplana borneensis*. A, tête, face ventrale. B, schéma de l'appareil copulateur. Les petits chiffres indiquent les segments successifs du canal éjaculateur.

Les seules *Cotyloplana* anatomiquement connues étaient celles de l'île Lord Howe. D'après la figure de Graff (57, p. 208), la topographie est fort différente. Il y a bien une poche musculaire, mais qui sert de gaine au pénis, lui aussi petit (plus long dans une autre espèce) et recevant un canal éjaculateur sinueux et glandulaire (mais dans sa partie terminale). Aucun vagin ne précède l'oviducte commun; le fond glandulaire de l'atrium correspond peut-être à notre bourse. On pourrait aussi tenter un rapprochement avec des *Rhynchodemus* comme mon *Rh. hirudineus* (de B. 1930 b. pl. 8, fig. 2) : en supprimant le second canal ♀ qui s'ouvre dans sa bourse copulatrice (et j'ai donné des exemples de pareille absence) on obtiendrait un plan assez comparable, sauf inversion des rapports entre elle et l'oviducte, l'organe ♂ ayant d'autre part un long canal éjaculateur à sections musculaires et glandulaires.

Genre *Dolichoplana* Moseley  
*Dolichoplana feildeni* Graff

Singapore, Avril 1911, John Hattenden.—Un exemplaire long de 180 mm.,  
sexué

„ 23. 4 1932, le Doux.—Un exemplaire sans tête, long  
de 40 mm., non sexué

Espèce de forme et d'ornementation suffisamment caractéristique (le premier individu est presque décoloré, mais on y reconnaît encore par places les quatre raies longitudinales). Sans doute circumtropicale, très répandue en Malaisie et déjà connue de Singapore.

*Rhynchodémidé Indéterminé*

Scotts Road, Singapore, Mars 1906.—Fragments de deux exemplaires ayant plus de 120 mm. et larges de 4, très cassants, forme rubanée et assez effilée aux extrémités, couleur brun foncé très excoriée, sole blanche non saillante ayant 1/3 de la largeur. Aucune trace d'appareil copulateur même sur coupes.

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EXPLICATION DE LA PLANCHE (TOUTES LES FIGURES  $\times 4$ )

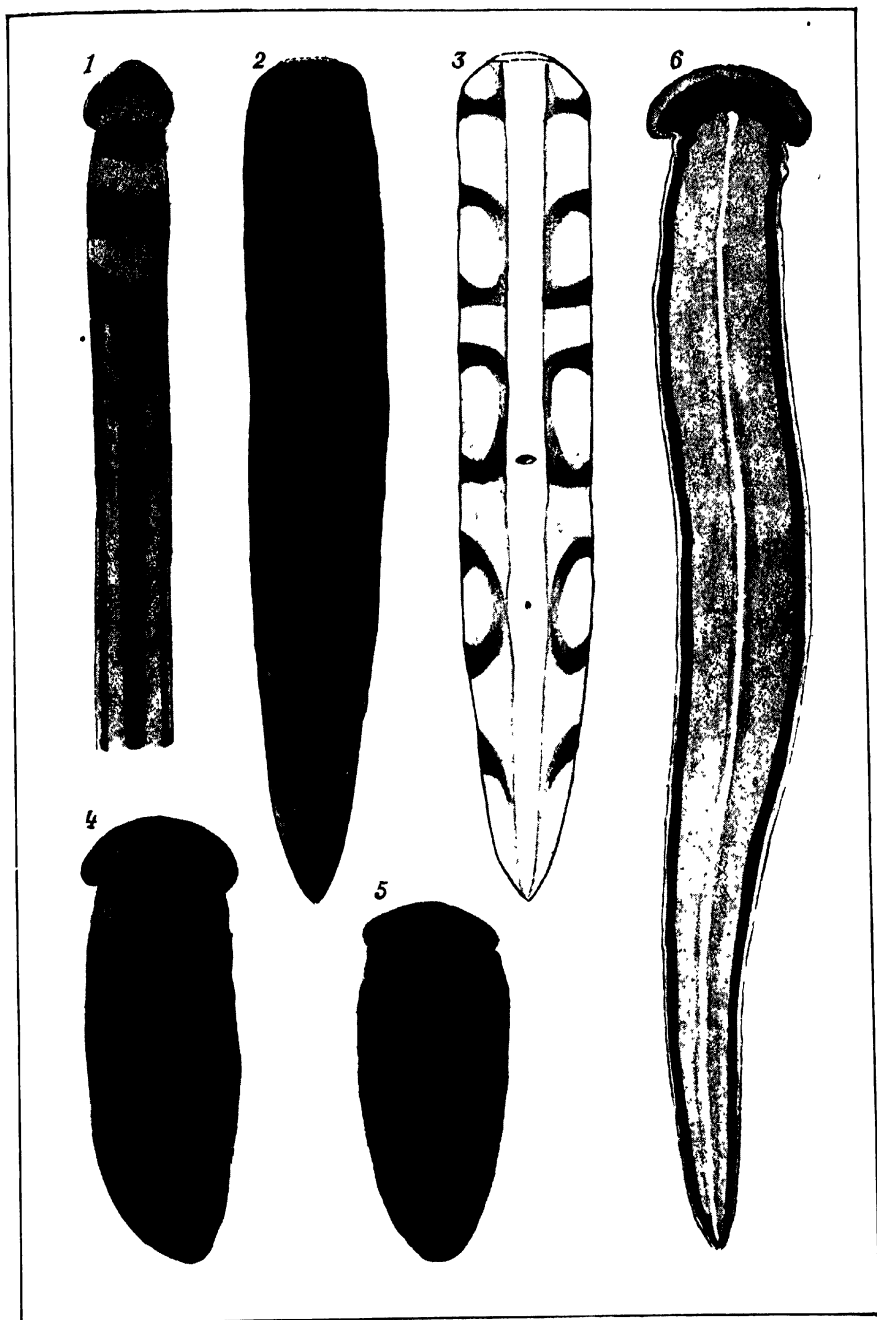
Fig. 1.—*Bipalium admarginatum* nov. sp., face dorsale.

Fig. 2.—*Bipalium simrothi*, exemplaire de Sedagong, face dorsale.

Fig. 3.—Le même, face ventrale.

Fig. 4 et 5.—*B. simrothi*, les deux exemplaires de l'île Aor, face dorsale.

Fig. 6.—*Bipalium everetti*, var. *longitudinalis* nov., face dorsale.



Planaires Terrestres (*Bipalium*).





## Notes on the Nidification of some Perak Birds

By A. T. EDGAR

The following paper contains the substance of notes made over a period of years, checked, verified and greatly extended by intensive observation during 1932 and the first half of 1933.

No attempt was made to go far afield in search of nests. All herein described were found within an area of four or five square miles, comprising rubber estate, kampong, secondary jungle, scrub and mangrove in the district of Sitiawan, Perak, Malay States.

Much of the work could not have been accomplished without the assistance of Enche' Teba bin Adam, a small landowner in the neighbourhood, and one of the best type of country Malay, keen, observant, and wise in the ways of Nature.

Malay names, where they appear in the text, are those used by the kampong people, in Sitiawan, Perak.

I am indebted to Mr. F. N. Chasen, Director of the Raffles Museum, for the identification of many of the birds, and for no small measure of help and encouragement in other directions.

These notes are set down, in their incompleteness, as a starting point for further work, and also in the hope that they may be of some interest to those who, like myself, find pleasure in the sight and sound of bird life.

**Turnix javanica atrigularis** (Eyton). The Bustard Quail.  
Malay.—*pujoh*.

The breeding season in this part of the country appears to be from January to June. My earliest record is of four chicks, hatched on 2nd February; my latest, a very young bird, seen on 11th June. The majority of nests and nestlings were seen in February.

The nesting site generally chosen is a small natural hollow, in grass land or light lalang (*Imperatora koenigi*), under the shade of a bush or young coconut palm. I have found only one nest not so shaded; this was placed amongst fairly thick lalang. The bottom of the hollow is thinly lined with dry grass or straw. The front of the nest is left open, and the sides are protected by sloping walls of dry grass, often intertwined with the living grass stems, and rising at the back to two or three inches in height. Most of the nests face north or west, a few south. I have not so far found one facing due east.

On 15th March, 1932, I found a nest in hoed padi-stubble. A large clod had been left in a semi-upright position and under this the bird had apparently scratched a hollow, which it lined as usual with straw. No walls of any sort were needed, as the eggs were already completely protected from the weather.

Nests may also be found amongst creeping cover-crops (*Calapogonium* etc.) on rubber clearings.

The full clutch of eggs is almost always four, occasionally three, and once, in my experience, five. The average size of sixteen normal eggs is  $.93 \times .8$  inches, but one clutch of exceptionally small eggs averaged only  $.87 \times .75$ . The shell is tough and glossy; in shape a round oval, pointed at one end. The ground colour is greyish olive, heavily marked all over with spots and blotches of varying shades of brown. The density and size of the markings is very variable. Some eggs are fairly uniformly marked all over; others have the blotches much bigger and darker at the larger end.

The nestlings, which are able to run as soon as they are hatched, are lively little things, clad in down. They are brown, paler below, and marked on the upper parts with various shades of lighter and darker brown.

***Excalfactoria chinensis chinensis* (Linn.).** The Blue-breasted Button Quail.

Malay.—*pikau*.

This little quail will be found nesting in situations similar to the last described species, but the eggs are quite different. Generally, they are laid in a small hollow which has been scantily lined with dry grass. Another favourite site is the centre of a tussock, and in such a position the nest is sometimes slightly more elaborate, because in addition to constructing the customary light pad on which the eggs are laid, the bird occasionally weaves dry grass in and out among the living grass stems, making a loosely woven circular cup which may be as much as four inches deep.

The nesting season is from January to April: the clutch, generally six or seven, and I have once seen as many as eight. The eggs vary from rather broad to longish ovals, sometimes sharply pointed at the smaller end. Their ground colour is olive brown, marked all over with very small dark brown specks. Viewed through the blow hole, the inside of the egg is sea green. The average size of 14 eggs is  $.98 \times .78$  inches.

Nestlings of this species may be distinguished from those of *Turnix* by the possession of four toes: *Turnix* has only three.

***Streptopelia chinensis tigrina* (Temm. and Knip).** The Malay Spotted Dove.

Malay.—*tékukor*.

The nest and eggs of this common bird must be familiar to most people in Malaya. According to Robinson, however, there is little definite information on record about the breeding season, and for this reason, I give the following extracts from my notes.

## NOTES ON THE NIDIFICATION OF SOME PERAK BIRDS

I have found nests and eggs as early as November but the greatest number in January, February and March, and others up to the end of May.

I have not seen a nest actually on the ground, but one, in January, 1926, was on a pile of sticks not a foot high, in the middle of a padi field. Another found in January, 1932, was no less than twenty-five feet from the ground, on a bamboo stem. Generally, nests may be found in bushes or small trees, between four and ten feet from ground level, often in most exposed positions. The nest is a loosely constructed pad of small twigs, rootlets, and sometimes coarse grass, the pad being about six inches in diameter and one to one and a half inches in depth. The eggs, two in number, are white, glossy, regular ovals, and measure about  $1.10 \times .86$  inches.

In February of this year I found a nest in a peculiar position. The padi harvest was over, and the temporary huts in the padi-land had been vacated. Inside one of these huts was the usual small corner shelf of split nibongs, and on this, a dove had built its nest, and hatched out its young. Unfortunately, though safe from wind and weather, the site was not rat proof; and when the young birds were ten days old, they were killed and partly eaten by those voracious pests of the padi-fields.

*Geopelia striata striata* (Linn.). The Barred Ground Dove.

Malay.—*merbok*.

The nest of this little dove consists of nothing more than a few intertwined twigs and rootlets. Smaller and flimsier than the last described, it is, in my experience, generally placed at a greater height.

The usual position is between eight and twenty feet from the ground, on top of a small lateral branch, although I found a nest in March, 1932 placed in a low coconut palm in the hollow at the junction of frond and stem: and this year, two nests in low bushes, only four feet from ground level.

I have found nests from November to May, and saw a bird carrying nesting material on 23rd May.

The eggs are white, oval, not glossy, and measure about  $.88 \times .65$  inches. Two are laid.

*Amaurornis phoenicura chinensis* (Bodd.). The White-breasted Water-hen.

Malay.—*ruak-ruak*.

I took a nest of this species on 24th March, 1932 on the edge of a small stream in the middle of a thick patch of lalang. The foundation of the nest was made by folding over and interlacing blades of green lalang to form a pad, which was supported also by thick grass which had grown up amongst the lalang. The nest was about three feet from ground level. The top of the pad,

about six inches in diameter, was slightly depressed to receive the eggs, and lightly lined with dry lalang. The points of the blades of the surrounding lalang were eight to ten inches higher than the egg chamber, and effectually concealed the nest, which would probably never have been found had not the Japanese owner of the land decided to slash the undergrowth on the banks of the stream.

Another nest, found in February 1933, was similarly constructed, but placed in a rather more exposed position, quite close to a path, on the edge of a buffalo wallow, in lalang only a foot high. Two nests seen in May were better hidden, both being in the centre of thickets of *Melastoma*, lalang, and *Lygodium* creeper, about six feet from the ground. In each case the eggs were laid on a pad of dry lalang, which was supported by the surrounding green and decaying vegetation.

One clutch of four eggs, and one of three, were in an advanced state of incubation: the other nests each contained three eggs. The eggs are variable in size and shape. In the clutch of four, one, measuring  $1.69 \times 1.15$  inches, was a long oval, pointed at both ends. Another,  $1.55 \times 1.12$ , was pointed at the end most heavily marked, blunt at the other. A third,  $1.62 \times 1.14$ , was a perfect oval: and the last,  $1.55 \times 1.14$ , a rather rounded oval. The average size of ten eggs is  $1.55 \times 1.11$  inches.

The ground colour is pale buff, freckled and blotched all over with reddish brown, and with underlying markings of paler colour. The distribution, density, and boldness of the markings varies in different clutches. The shell is not at all glossy, and in some eggs has a slight greyish bloom.

*Limnobaenus fuscus fuscus* (Linn.). The Ruddy Crake.

Malay.—*sintar bras*.

Two nests of this species were found on 29th April, within a few yards of each other, in a thick growth of grass, lalang and rushes on the edge of a ditch. The land is flooded during most of the wet season.

The nest was well concealed, being about a foot from the ground in the centre of a tussock two and a half feet in height. It was a pad of dry grass, four inches in diameter and a little over an inch deep, the eggs being laid on a thin layer of dry lalang. Another nest, similar in all respects, was found on 15th May.

The bird, when disturbed, slipped off the nest and into the undergrowth like a rat. It was necessary to obtain it for purposes of identification, and it was eventually caught at night, on the nest, with a casting net.

One of the nests contained only one egg, another had a clutch of three, which, when blown, were found to be in varying

stages of incubation; and a third found at a later date had four eggs. The eggs are pale stone colour, lightly marked all over with small spots and blotches of reddish brown, and with underlying markings of pale purplish grey, the latter more thickly congregated at the larger end. Slightly pointed ovals, with very little gloss, they measured on average  $1.23 \times .9$  inches, in one clutch, and in the other,  $1.16 \times .89$  inches.

**Hypotaenidia striata** (Linn.). The Blue-breasted Banded Rail. Malay.—*sintar*.

Nests of this rail are found from November to May, and may frequently be come across by snipe shooters, as the nest is almost always situated in land where one may expect to find snipe.

On 2nd November, 1930 a nest was found in standing padi, and in December I found two nests close together, in tufts of grass on the edge of a padi-field. These three nests were raised nine to twelve inches above the ground, which was flooded at the time to a depth of six inches. A fourth nest, seen in May, was also raised a little above the ground, which was then quite dry: and a fifth, in January, was as usual placed in the centre of a grass tuft, but this time actually on the ground, on the bank of a small stream.

It would naturally be expected that *Hypotaenidia* would prefer to breed in the immediate vicinity of water, and in March this year I was greatly surprised to discover a nest, at least one hundred yards from the nearest ditch, and placed amongst short grass, on the hard sun baked clay of a rubber clearing; this was more remarkable because not far away was a considerable area of low-lying, swampy land, which, one would have thought, contained innumerable nesting sites more suitable than the one chosen.

The nest itself is merely a pad of dry grass, like that of *Limnobaenus*, but slightly larger and thicker. The clutch varies from four to six, it is probably only accidental that nests noted early in the season had generally four, occasionally five, and that the only nest I have seen with a clutch of six, was in May.

The eggs, rather rounded ovals, without gloss, are pale stone colour, boldly marked at the larger end with blotches of brown and chocolate, underlaid with purplish grey, and elsewhere more sparsely spotted with reddish brown. The average size of seven eggs is  $1.26 \times 1.06$  inches.

The nestlings are clad in black down.

**Butorides striata javanica** (Horsf.). The Little Green Heron. Malay.—*puchong bakau*; *puchong kēlabu*.

Stretching along the coast for some miles, between the mud flats and a belt of rough secondary growth and kampong, is a

strip of "hutan perepat", a mixed stand of trees of the mangrove class, "perepat" (*Sonneratia* sp.), "api api" (*Avicennia* sp.) and others. At high tide, the water is from knee to waist deep; at low water, the mud is exposed.

To one part of this "perepat" forest, round the mouth of a small creek, the little green herons come to build their nests. All my nests were found in an area of roughly four acres.

It seems probable that these birds nest twice a year. Eight nests were found between 23rd January and 16th February and between 8th June and 2nd August, six nests. No new nests were seen in March, April or May, through the area was visited on several occasions and nests of many other species were found.

The nest, which is a loosely constructed platform of small twigs, ten inches to a foot across and about two inches deep, may be placed at any height from eight to thirty feet above the mud, on a lateral branch. The usual clutch is three. The eggs are always very much coated with dried mud, but when this is removed, are seen to be a pale bluish green, and smooth in texture. Their shape varies from regular to broad oval, and measurements of eight average  $1.51 \times 1.11$  inches. One egg measured  $1.63 \times 1.14$ ; the others were all between  $1.4 \times 1.09$  and  $1.57 \times 1.11$  inches.

When the eggs are being brooded, the other parent is generally close at hand, often on a higher branch of the same tree. When disturbed from the nest, the brooding bird flies in a wide sweep and shortly returns, to sit crouched, bill pointing forwards, on a nearby branch; occasionally moving, in a stealthy, cat-like manner, the better to watch the intruder. While so occupied, it makes at intervals a clicking noise; the true note of alarm is a harsh, bark-like squawk.

The young birds are clad in grey down. Taken while still not fully fledged, and fed on a diet of small fish, they become very tame and confiding. A Malay kept three for some months, in a large roomy enclosure under his house. They were voracious feeders. Once, when the son of the house was chopping pieces of fish, one of the birds greedily snatched, just as the knife descended, and in consequence lost three quarters of an inch of its lower mandible; but it seemed none the worse for the accident and lived in as good condition as the others, till a prowling cat or "musang" got in one night, and killed all three.

So long as only one or two persons approached their cage, the birds were quiet; but when too much notice was taken of them, or when a dog or cat came near, they showed disapproval by raising their wings, partially erecting the crest, and uttering a kind of hiss.

I agree with Robinson as to the diurnal habit of this heron, at any rate on the coast. I have repeatedly watched birds feeding on the mudflats, often during the hottest hours of the day.

**Cuncuma leucogaster** (Gmel.). The White-bellied Sea-Eagle.

Malay.—*lang siput, lang laut*.

The huge nests of *Cuncuma* must be familiar to many people whose pleasure or duty has taken them to the quieter parts of the Malayan coast. Built in tall trees, and used year after year, the nests are extremely conspicuous. One seen on 7th February, sixty feet from the ground in a tall "perepat" tree, was four feet deep and six feet across, a huge pile of sticks. A roughly circular depression on the top of the nest was lined with "perepat" leaves, and thereon sat the two nestlings. The parent birds flew round and round in narrowing circles all the time my man was climbing the tree, calling loudly and swooping dangerously near as he reached the nest; but the young birds uttered no sound, merely gazing in wonder at this strange intruder from the outside world.

When the interruption was over, the parent birds signalled their relief by making an unprovoked attack on a pair of crows and a pair of Brahminy kites, driving them away with the maximum of noise and exertion.

While fishing off one of the Sembilan Islands early one morning in March, I watched two sea eagles at their nest, placed in a fork, six feet below the umbrella top of a tall tree. There were young birds in the nest, and their shrill screaming could be heard from some distance away, ceasing only when one of the parents returned to the nest with a fish, and later, a sea-snake.

**Spizætus cirrhatus limnætus** Horsf. The Changeable Hawk-Eagle.

Malay.—*lang borek, lang hindek*.

This fine bird also nests in tall trees, but the nests I have seen are much smaller than the gigantic structures made by *Cuncuma*. A nest seen on 20th April, eighty feet from the ground in a tall "ipil" tree (*Intsia* sp.) growing in a small patch of swampy jungle ten chains from the sea, contained a single juvenile, almost ready to fly. The egg-chamber of the nest was lined with green leaves.

The following year, on 20th January, the nest was again tenanted, and an egg was obtained. A broad oval, bluntly pointed at the smaller end, it measured  $2.6 \times 2.08$  inches. The surface is chalky, the colour dirty white, with a few indistinct blurred marks of dull reddish brown. The inside of the shell has a strong sea-green tint when looked at through the blow-hole.



**Haliastur indus intermedius** Gurney. The Brahminy Kite.

Malay.—*lang tembikar*.

This is a coast-haunting bird, and breeds in the mangroves, usually in January, February, and March.

The nest, which is generally not less than forty or fifty feet from the ground, is a pile of sticks about two and a half feet in diameter, but only six to twelve inches in depth. The eggs are laid on a pad of dried clay, four to six inches across and about an inch thick.

A nest seen on 2nd February contained two eggs, just cracking. The parents, both of which were in attendance, perched on trees some distance away, and made no sound while the nest and eggs were being inspected.

The following year, on 2nd January, I took two eggs from another nest, not far from the first. They are round ovals, compressed at one end, measuring  $2.09 \times 1.62$ , and  $2.05 \times 1.60$  inches. The shell is tough, the surface chalky and dirty white in ground colour, one egg very sparsely marked with small red-brown specks and scriggles, the other with quite a number of fine dots and lines, mostly congregated at the smaller end.

Like that of the last species, the egg shows green through the blow-hole.

**Elanus cæruleus cæruleus** (Desf.). The Black-winged Kite.

Malay.—*lang tikus*.

This graceful bird, which feeds mainly upon rats, may be seen hovering or quartering over an area of padi stubble.

Some years ago, in early June, a pair nested in the umbrella top of a tall solitary tree, on the edge of the padi fields, and brought out a single young bird.

This year on 21st February, in an abandoned holding, overgrown with lalang and scrub, I found a nest, eighteen feet from the ground in the leafy top of a young rubber tree. It was an untidy pile of sticks and twigs, twelve inches across by eight inches in total depth, the egg chamber being merely a depression, six inches in diameter by four inches in depth, and lined with smaller twigs.

It contained a single egg, a round oval, measuring  $1.51 \times 1.25$  inches. The shell was glossless, creamy white in ground colour, heavily splashed and marked all over with varying shades of chocolate and brown: from their appearance, the markings might have been made by a carelessly applied paint brush. Like the eggs of other birds of prey, it showed green through the blow-hole.

It is interesting to note that on this occasion and also about three months later, when the second brood of two young birds was about to leave another nest close by, only one parent was in

attendance. With the larger kites and eagles, I have noticed that both parents generally remain within calling distance of the nest.

**Ninox scutulata malaccensis** (Eyton). The Malay Hawk-owl  
Malay.—*punggok*.

A pair of rollers (*Eurystomus orientalis*, Malay "tiong batu," "tiong kareh") had for some time been watched, entering and leaving a hole, thirty-five feet from the ground in a "perepat" tree. On 19th March, I went to the spot, and found both the rollers very agitated and noisy, perched on the branch of a tree nearby. I wished to obtain a specimen of *Eurystomus* in breeding plumage, and so shot the bird, a hen, which was later found to have eggs in the oviduct. On the ground immediately under the branch on which she had been sitting, we found a broken egg, freshly laid, which she had apparently dropped. Puzzled, I sent my man up the tree, and as he reached the nest hole, an owl (*Ninox*) flew out. There was one egg, laid on the dead wood at the bottom of the nest hole, which was a foot deep, and unlined. The entrance hole was too small to admit a hand, but the egg was removed by slightly widening another hole, lower down, which also led to the nest-chamber.

A fortnight later I returned to the tree, and found that the owl was sitting on two eggs, one of which I took, leaving the other, which was eventually hatched.

What must have happened was that the Rollers, which had for quite a long time been intending to use the hole for nesting, had at the critical moment been dispossessed of their home by the owls.

The eggs which were white, with very little gloss, measured  $1.45 \times 1.22$  inches.

Another nest, similarly situated, was found on 5th May to contain a single young bird.

**Alcedo atthis bengalensis** (Gmel.). The Kingfisher.

Malay.—*pěkaka kěchil*.

A pair of these exquisite little birds had established territorial rights over the vicinity of a fish pond, from the teeming inhabitants of which they could select their daily meals with the maximum of convenience and the minimum of exertion.

They nested in a "live" white-ant hill near to the water's edge. The entrance was about one and a half inches in diameter, the tunnel itself only extending some six inches horizontally inwards, and widening, though not greatly so, to form the egg-chamber which had no lining except a few fragments of fish bone: at the back of the egg-chamber, which could be seen from outside, termites were moving about, at their ordinary occupations.

On 20th February, there were two eggs, which were found to be partly incubated: this shows that *Alcedo* occasionally lays a much smaller number of eggs than the clutch of five to seven with which it is credited in other parts of its range.

The eggs were elliptical ovals, very slightly compressed at one end: white, glossy, and with a rather delicate shell. They measured  $.87 \times .68$ , and  $.85 \times .66$  inches.

*Halcyon smyrnensis fusca* (Bodd.). The White-breasted Kingfisher.

Malay.—*pēkaka*.

The nest of this kingfisher may be found from February to May, and consists of a tunnel, fifteen inches to two feet in length, excavated horizontally in the bank of a drain, or well, and generally only nine inches to a foot below ground surface.

I have seen nest tunnels in all sorts of soil, from light sand to stiff, unyielding clay. The entrance is just too small to admit one's hand, but the tunnel broadens at the end into an egg-chamber, usually about nine inches in diameter by five inches in height. On the floor of the chamber there are almost always a few small fish bones, or the wing and leg-cases of a species of coppery beetle. These are apparently the fragments of meals eaten by the brooding bird, as they are found while she is still sitting on eggs.

The full clutch seems to be five, but I have found numerous nests containing only four. The eggs are white, glossy and translucent, and the yolk is a deep orang colour. Broad ovals, the eggs measure about  $1.16 \times 1.02$  inches (average of eleven).

As the nestlings grow up they become extremely noisy, and attention is attracted to the nest by their squeaking. They are ugly little things; each feather is enclosed in a sheath, which gives the young birds a peculiar spiny appearance. The process of extracting a nestling, for examination, is unpleasant in the extreme; the tunnel, and the bank below its opening, are always in a filthy condition.

*Halcyon chloris humii* Sharpe. The White-collared Kingfisher.

Malay.—*raja udang*.

*Halcyon s. fusca* is normally a garden and kampong bird, not usually found in the mangroves. This species, on the other hand, is never, or at least very rarely seen away from the coast, where it is a conspicuous bird, being even noisier than the last.

The nesting season extends from January to August.

On 10th February, I found a nest containing three young birds. This was a tunnel, three feet long, excavated in the soft earth at the roots of a fallen coconut tree, on the shore.

On 23rd March, a nest, also containing three nestlings, was found in a hole, about nine inches long, in a "live" white ants'

## NOTES ON THE NIDIFICATION OF SOME PERAK BIRDS

nest which had been built up round the base of a thorny palm, in scrub just above high-water mark.

With these two exceptions, all the nests I have seen have been in holes in trees. A "perepat" tree, the heart-wood of which has rotted, is the favourite site. The entrance hole is small, but inside the bird excavates a nest-chamber, which it uses quite unlined, the eggs being laid on the soft decaying wood. The distance from the entrance to the back of the chamber is often only six inches, never more than a foot. Frequently the floor of the chamber is several inches lower than the entrance hole, but this seems to vary according to the condition of the wood inside the tree, and whenever possible the bird tries, I think, to save itself the trouble of doing any more excavation than is necessary.

The great majority of nests are from six to ten feet above the mud, which means one to five feet above water level at high tide, but I have seen two nests no less than thirty feet up the trees.

The eggs are white, somewhat glossy, and faintly translucent. Generally they are broad ovals, sometimes slightly pointed at one end, and eggs of this type average  $1.14 \times .96$  inches. Three eggs in one clutch, however, were longer ovals slightly pointed at both ends, and averaged  $1.21 \times .98$  inches. In the nest the eggs are usually coated with dried mud, no doubt from the feet of the brooding bird. The clutch is almost always three but very occasionally only two eggs are laid.

**Ramphalcyon capensis malaccensis** (Sharpe). The Stork-billed Kingfisher.

Malay.—*pěkaka bėsar*.

A nest of this, the largest of local kingfishers, was found on 27th March, about fifty yards from the bank of a small river.

It was excavated in the base of a white-ant hill, the entrance hole being nearly four inches in diameter. The tunnel, only six or eight inches long, led to a spacious egg-chamber nearly a foot in diameter.

Attention had been attracted to the nest by the behaviour of the parent bird, which was noticed swooping down from a tree into the short lalang, and immediately returning to its vantage point, this proceeding being repeated several times.

On investigation the nest was found to contain a dead nestling, which the red ants were trying to remove, and an addled egg. The floor of the egg chamber was covered with fish-bones, the wing-cases of beetles, and small fish in varying stages of decay.

The egg was white, glossy, a short, regular oval, measuring  $1.48 \times 1.11$  inches.

**Anthracoceros coronatus convexus** (Temm.). The Southern Pied Hornbill.

Malay.—*lang ling*.

In a small area of swampy jungle, near the coast, at the foot of a large "nyireh" tree (*Carapa moluccana*) my ranger noticed the feather of a hornbill. Thinking there might be a nest near at hand, he withdrew about thirty yards, and sat down to watch. Before very long his intelligence was rewarded by the sight of the male hornbill, which arrived with a berry of some kind, and perching on the side of the "nyireh" trunk like a woodpecker, proceeded to feed the sitting bird through the slit in the nest wall.

The next day, 9th March, I went to see the nest. Although it was only eighteen feet from the ground, its existence would never have been suspected but for the lucky accident of the day before. As is well known, it is the habit of hornbills to plaster up the entrance to the nest-hole once the hen bird is inside, with a substance resembling dry mud or clay. In this case, the opening left to provide the bird with air and food was a mere slit, two and a half by one and a half inches in size.

The eggs had newly hatched. On the first day, when the ranger climbed up to the nest, there had been no sound except a slight protest from the parent; on the 9th, the squeaking of the two young birds could be plainly heard. The opening was widened, slightly, with a parang. The mother bird became extremely noisy, and the vicious stabs she made at the point of the parang left no doubt as to the reception she would be likely to give to any prowling arboreal mammal or reptile.

A day or two later, when I next visited the nest, the opening had been plastered up again to its original size. I have no record of the date on which the mother and young birds left the nest, but they were still in residence on 9th April, a full month after hatching.

I have been informed by Malays that the same nest hole is used year after year: one old worthy told me of a tree in which, until it was blown down by a gale, hornbills had nested, within his recollection, for twenty years. Be that as it may, in January of the following year I took an egg from the nest described above.

It seems that the hen hornbill is immured some days before she is actually due to lay. I had reliable information that she was in, and plastered up, on 17th January. I did not visit the nest till the 24th to make sure of finding the full clutch, but the single egg then obtained was quite fresh.

Measuring  $1.7 \times 1.42$  inches, it was almost equally rounded at both ends, close in texture, and quite without gloss. Dirty white in colour, it was much stained by the juice of some large

purple berries on which the bird had been feeding, and the remains of which, together with some small slivers of decaying wood, were the only lining to the nest.

I was surprised to find that the parent, which the year before had been most noisy in defence of her offspring, on this occasion allowed the egg to be removed without uttering a sound, although, to begin with, she certainly attempted to make full use of her formidable bill.

***Merops viridis viridis*** Linn. The Chestnut-headed Bee-eater.

Malay.—*běrek běrek*.

Most observers seem to have noted this species as nesting in precipitous sandy banks. This is no doubt its habit in places where such a site is obtainable, but here, where there are no such banks, colonies of birds make their nest burrows in flat sandy areas. These burrows are generally over three feet in length. I opened up one, which the bird was just finishing, which measured six feet from entrance to egg-chamber; it sloped gently from ground level to two feet below the surface, the slope flattening out just before the egg-chamber was reached.

Nesting takes place generally in April and May, and the same sites are used year after year, though of course the actual burrows have to be dug out afresh each season. I have found eggs as late as 9th July, but this is exceptional. Quite often stray eggs may be picked up from the ground near the entrance to the burrow.

The clutch varies. Five is the greatest number of eggs I have seen, but in April, 1932 I took a clutch of three partly incubated eggs, and have since seen several nests, the full clutch of which was three or four. The eggs are rather rounded, and are laid on the bare floor of the nest-chamber. When taken from the nest they have a greyish appearance due to the sand particles with which they are covered, but when washed they are white and slightly glossy.

They vary somewhat in size: the average of eleven normal eggs is  $.91 \times .8$  inches, but I have one egg measuring  $.99 \times .82$ , and a clutch of three which average only  $.84 \times .76$  inches.

After the nesting season is over, *Merops viridis* leaves the district, and its place is taken, from August onwards, by the Brown-throated Bee-eater (*Merops superciliosus javanicus*) which species disappears, in its turn, before *M. viridis* returns to breed in the spring.

***Caprimulgus macrourus bimaculatus*** Peale. The Long-tailed Nightjar.

Malay.—*burong tukang; burong sĕgan*.

This bird, whose monotonously reiterated call is disagreeably familiar to most Europeans in Malaya, breeds from January to

April. It lays two eggs, regular ovals, which measure generally about  $1.18 \times .88$  inches. Quite frequently, however, eggs in the same clutch will be found to differ appreciably in size. The largest egg of which I have a record measured  $1.37 \times .87$  inches.

The ground colour is pinkish buff, sparsely spotted and blotched with darker buff, and sometimes with pale purplish brown, or purplish grey, the latter markings being often congregated near one end of the egg. I have one egg with an irregularly shaped splash of chestnut-brown, from an eighth to a quarter of an inch in width, running diagonally for three quarters of the length of the egg: elsewhere there are hardly any spots at all.

No nest is made, the eggs being laid on the bare ground, or on sand, usually in the shade of a low tree, bush, or palm, and amongst fallen leaves, in which position their colouring tones so well with the surroundings that it is often difficult to spot them at first glance, even though the sitting bird has been seen to rise.

When the eggs are near to hatching, the bird sits very close. I have sometimes approached to within two or three feet of a sitting bird, without its moving in the slightest degree. In such a case, I have noticed that the bird closes its eyes, no doubt lest their reflected light should draw attention to its presence. When disturbed, one bird left her eggs with an upward jump, and, after two or three wing flaps, came down again a few feet away, body pressed close to the ground, and wings extended. Making a loud hissing noise, it violently agitated its pinions, and, in fact, the feathers of the back and mantle seemed also to be raised and trembling. After a moment, it retreated another ten yards, and repeated the process. Finally, it took up its position on a low branch thirty yards from me, and remained so until I had gone, leaving it to complete an incubation which was almost at an end, for from the eggs, which I did not touch, could be heard the faint cheepings of the young birds.

If, as often happens, the eggs have been laid in an exposed position, such as among the fallen leaves of a rubber estate, the bird sometimes moves her nestlings, soon after hatching, to a place of greater security—the lalang edge, or the shelter of some scrub.

My attention was first directed to this peculiarity some time ago. I was anxious, if possible, to obtain the eggs of *Lyncornis*, the eared nightjar, and I had been making enquiries in a locality where that species is comparatively numerous. A Malay found a *Caprimulgus* nest. Like a number of other people, he had an idea that the *tap-ti-bau*, when his aerial antics are over

descends to lower levels and changes his note to the *tock-tock* of *Caprimulgus*; so he caught the bird, on the nest, and brought it, and the eggs, a distance of about five miles, by bicycle.

The eggs were nearly hatched, one of them having already cracked. The bird was quite unharmed, so I decided to try whether she would complete the incubation. One end of the vegetable garden was lying fallow, and grown up in weeds and small plants. Near this, under a low shady tree, I placed the eggs, and was delighted to find that the bird, when gently settled on them, immediately commenced to brood.

That was in the evening. At seven-thirty, seen by the light of a torch, she was still brooding. In the morning there was only one egg. I went out, and did not return till after ten, when my servant told me that, at seven, the bird had been back at the nest. I went to look, but both egg and bird had disappeared. Any interference by dog, cat, or human could be ruled out, and I was inclined to the belief that she had moved her nestlings soon after they hatched.

Since then, I have definite proof that one brood moved at least twenty yards the day after hatching, and another, about the same distance, probably on the second day. I saw a fledgling, which had grown to about bulbul-size, follow its mother, whom I had disturbed, by shuffling itself along the ground, pushing, it seemed, with its partly feathered wings: but how are the very young nestlings transported to a more secluded spot?

In a note, published in the *Singapore Naturalist* (1923), Mr. C. J. Saunders mentions having heard a nightjar call by daylight in April, 1918, April, 1919, and at about the same time of year in 1922. Towards the end of April this year, two young nightjars took flight from a nest not far from my house. From 30th April, to 7th May, I heard nightjars calling by day, at 11 a.m., 2 p.m., and in the afternoon. From the dates recorded, I suggest that the day time calling is either communication between parent and youngster, or an inexperienced effort on the part of the young bird itself.

***Micropus affinis subfurcatus*** Blyth. The Malay House Swift.  
Malay.—*layang layang*.

The nests of this swift must be familiar to everyone, so common is it in the towns, and so frequently seen at country bungalows, where its attempts at housekeeping have not been frustrated by an intolerant human host.

Plastered against walls and under verandahs, they are added to and repaired year after year. Robinson mentions the species as breeding on lofty cliffs, and I have found their nests under a



concrete jetty: their choice of a nesting site is therefore not always limited to human habitations, as is believed by some.

The eggs are usually two, sometimes one, or three; generally they are long and pointed, but occasionally specimens are typically "egg shaped.". The average size of a dozen eggs is  $.91 \times .60$  inches, but they vary considerably from .87 to .98 in length, and from .57 to .64 in breadth. The colour of the shell is dull white, without gloss. Quite fresh eggs may be faintly translucent.

I think that two broods are raised. In some nests which I observed, breeding took place in March and April, and all the young birds had flown by the middle of May. Early in July, many of the nests again contained newly hatched nestlings.

It is perhaps of interest to note that a breeding colony of swifts, and a hive of wild bees, have lived for months under the same verandah, neither interfering with the other, and the bees showing no displeasure even when swifts continually dash in and out within inches of the hive.

*Centropus bengalensis javanicus* (Dumont). The Lesser Crow-Pheasant.

Malay.—*but-but*.

A nest of this species was found on 13th January, in thick lalang on the edge of a patch of scrub. Three feet from the ground, it was a domed structure, ten inches in height by nine inches in outside diameter, made entirely of dry lalang, loosely woven, and attached to the living grass, some blades of which were bent over and woven into the dome. At one side an oval entrance, five inches by four, led to the egg-chamber, the floor of which was lined with half a dozen green leaves of a creeper which grew nearby. The two chalky white eggs, which were very much incubated, measured  $1.16 \times 1.04$  inches. A clutch seen the following year, on 1st January, also consisted of two eggs. One of these had a very chalky surface; the other was quite smooth, and when collected, had a slight gloss, which it has now lost. They were rather longer ovals than those described above, and measured  $1.24 \times .89$  and  $1.22 \times .92$ , respectively.

On 24th February a nest was found, which contained a single nestling. A repulsive little object, it was quite black, with enormous feet. Its feathers were still in sheath, and the head and upper parts covered with white bristly hairs, about an inch and a quarter long.

The "but-but" has a bad reputation as an egg thief, and is also said to eat nestlings of smaller birds, bulbuls, munias etc. I have no personal evidence of this, but see no reason to doubt my informants.

**Phœnicophaus curvirostris erythrognathus** (Bp.). The Malay Chestnut-breasted Malkoha.

Malay.—*chěnok*.

In a patch of scrub, near the sea on 15th January, 1932 I found a nest which was situated ten feet from the ground, in a short shrubby tree. It was a loosely built structure of sticks, and the egg-chamber consisted merely of a depression in the top of the nest, smaller twigs being used for its lining.

The nest contained three young birds, fat, black-skinned, with greedy gaping mouths, the insides of which were a bright red.

**Dryobates moluccensis moluccensis** (Gmel.). The Lesser Pigmy Woodpecker.

Malay.—*bělatok kěchil*; *bělatok pěrěpat*.

This small woodpecker is by no means uncommon in the "perepat" forest. I have not come across it more than a mile from the sea.

Its nesting period extends from March to July. The nest is a hole in very soft dead wood. A favourite site is the extreme end of a dead horizontal branch, in which case the entrance hole is generally on the underside. The opening is about one and half inches in diameter, and circular; the chamber extends inwards from six inches to a foot, either horizontally or downwards.

I have seen nests at heights varying from twelve to sixty feet above mud level. Some of them were quite impossible to obtain.

Three eggs, taken on 30th March, were white, translucent, rather glossy, and pointed at one end: two taken on 8th June were round ovals. The size varies from .69 × .52 to .75 × .53 inches. The normal clutch appears to be two, as I saw nests on 21st March and 15th July, each containing two nestlings.

**Dinopium javanense javanense** (Ljungh). The Golden-backed Three-toed Woodpecker.

Malay.—*bělatok kampong*.

This bird is by far the best known of Malayan woodpeckers, being common in garden and kampong areas. It does not as a rule frequent the mangroves.

The nesting season extends from January to July. The eggs, which are always three in number, are laid on decayed wood inside the trunk of a tree, the entrance hole being cut from outside by the bird. The nest-hole is generally fairly deep, in most cases about twelve inches. A dead or dying coconut tree is the favourite site, but any tree with soft wood will do, and I have seen a nest in a dead horse-mango tree (*Magnifera foetida*), a living "cashew" tree (*Anacardium occidentale*), and a decaying rubber branch. Most of my nests have been eighteen to twenty

feet from the ground; but the only one I have seen in the mangroves was in a dead "perepat" tree, only six feet above ground level.

Three eggs taken on 24th February were, when I found the nest, being brooded by the male bird. They were white, somewhat translucent, rather glossy, and round-oval in shape, and averaged  $.90 \times .75$  inches.

On 15th March, I took another clutch of three eggs; this time the female was on the nest. The eggs were long, pointed at one end, and their average size was  $1.03 \times .71$  inches. One egg was highly translucent, and the yolk showing through the shell gave the egg a beautiful pinkish blush. This egg was just beginning to incubate. The others, which were not translucent, were at different stages of incubation, both further advanced than the first egg.

Woodpeckers do not catch insects on the wing; but on occasion, the presence of a swarm of flying termites tempts them to the performance of aerial acrobatics quite foreign to their natural habit. I have seen this happen once or twice, notably one evening in June, 1930, while waiting for a flight of green pigeon. Bee-eaters, swallows, and swifts were flying round and round amongst the swarm, and three Golden-backed Woodpeckers joined them. Their attempts to hover were most amusing. Head and tail thrust forwards, wings beating furiously, they managed, for thirty seconds at a time, to maintain themselves in this curious position, as though sitting on the air. Each time the strain became too great, they flew in a wide circle, and, when refreshed, returned to the feast. This went on for quite ten minutes, till the swarm had finished.

*Picus vittatus vittatus* (Viell.). The Bamboo Green Woodpecker.

Malay.—*bēlatok hijau*.

This species is much less common than the last, and has not, I understand, previously been recorded from north of Selangor. A pair lived in my garden for a year or two, leaving at intervals, for two or three months at a time, I suppose to breed.

In March, there were two nests, thirty feet from the ground, in dead coconut trees, both quite unclimbable; one, in fact, fell in a gale before the eggs were hatched.

On 16th April, I found a nest in a hog-plum tree, about twelve feet from the ground. There were four eggs, quite fresh. Translucent, pinky white when unblown, they were pointed ovals, fairly glossy, and averaged  $1.04 \times .75$  inches.

The eggs of a clutch taken from a hole in a dead mango tree, on 3rd March of the following year, were somewhat larger, and not so sharply pointed at the smaller end. Their average

measurement was  $1.08 \times .83$  inches. I have a record of another nest, seen on 5th April, in an "api-api" tree, on the edge of the mangroves.

In "The Birds of Singapore Island", it is stated that specimens of this species, brought into the Raffles Museum, had the underparts sullied with mud, suggesting that the birds had spent some time on the ground. That this is at times their habit is corroborated by the fact that I have on several occasions watched a pair on the ground, where they appeared to be searching for small insects among the fallen leaves, in a rubber estate.

**Micropternus brachyurus squamigularis** (Sundev.). The Malay Rufous Woodpecker.

Malay.—*bēlatok*.

This woodpecker is by no means common here, and when seen, is generally in kampong country, in pairs.

It was somewhat surprising to find it nesting, about the middle of April, in the coastal scrub, an area covered with a dense growth of "piyai" and "bogin" (*Phoenix paludosa*, a relative of the date-palm). In the stem of a dead "bogin", about fifteen feet from the ground, it had excavated its nest hole, three inches in diameter at the entrance, the egg-chamber being about six inches in depth.

The eggs have a fairly tough shell. Two in number, they were beginning to incubate. White, not glossy, they are oval, almost equally rounded at both ends, and measure  $.95 \times .70$  and  $.96 \times .71$  inches.

**Callolophus miniaceus malaccensis** (Lath.). The Malayan Banded Red Woodpecker.

Malay.—*bēlatok*.

This very handsome and, locally, extremely uncommon species was found breeding in the mangrove belt on 20th June. The nest was a small hole, excavated in the dead wood of a "perepat" tree, about sixteen feet from the ground.

There were three eggs, which were fresh, and translucent when unblown. Their shape was oval, slightly compressed at one end. The shell was white, glossy, and fairly tough. They measured 1.05, 1.07 and 1.08 in length, and a uniform .8 inches in breadth.

**Xantholæma hæmacephala indica** (Lath.). The Coppersmith Barbet.

Malay.—*burong tukang bēsi*.

A nest of this species, found on 10th May, contained a single nestling. The nest was a hole bored horizontally into a "perepat" tree, about twenty feet from the ground, and had no lining. Another nest, seen on 13th April the following year, was a hole

in a rubber tree, about sixteen feet from ground level. This time there were two young birds.

**Cymbirhynchus macrorhynchus malaccensis** Salvad. The Black and Red Broadbill.

Malay.—*burong hujan hujan*.

Although it is said that this bird, in Malaya, does not frequent gardens and orchards, I find that it occasionally does so. In May this year I saw a nest, which, despite the efforts of the parents, was robbed by squirrels: this was attached to the end of a branch, about sixteen feet from the ground, in a garden bordered by a small strip of reserve jungle. Another nest was attached to the end of a *Casuarina* branch, in a garden bordering a mangrove swamp.

Three nests of the species were seen in April and May, 1932, in "perepat" trees. In each case the nest was attached to the extreme end of a lateral branch, at heights above the mud varying from twenty to thirty-five feet. The nest, which looks like a bunch of flood-debris, is a large untidy oval structure of roots, rootlets and twigs, interwoven with a quantity of fibrous material (dried bark). The one nest which I examined closely was eighteen inches from top to bottom, the top six inches being a sort of canopy, built loosely round the twig to which the nest was attached, the end of which, with green leaves still growing on it, struck out sideways through the top of the main body of the nest proper. The outside circumference of the nest, at the widest part, was no less than twenty-six inches.

A circular entrance hole, two inches in diameter, was placed centrally on one side, and protected by an eave. The egg-chamber was neatly lined with strips of bark taken from saplings of "baru" (*Hibiscus tiliaceus*); and three eggs were laid on a few green leaves of the "ara" (*Ficus* sp.).

Rather long ovals, not glossy, the eggs measured an average of 1.08 by .75 inches. The ground colour was pinkly white spotted all over with brown, most heavily at the larger end, where there were also some underlying markings of paler colour.

**Hirundo javanica abbotti** (Oberh.). The Malay Coast Swallow.

Malay.—*layang layang*.

The nest of this little swallow is a saucer of mud and straw, lined with feathers. Sometimes it may be found attached to the wall of a house, on top of a beam, or under an eave. In 1926, a pair of birds built on my bedroom verandah, starting the nest on 20th February, and finishing it on 10th March. Four eggs were laid but only two hatched, on 1st April. The young birds left the nest on 23rd April. The parents never got used to my

presence, and after the eggs had hatched, became a positive nuisance, screaming and swooping round my head every time I came near the nest.

On 17th May the same, or another pair, returned to the nest, and after cleaning it up, commenced to lay on 21st May. Again four eggs were laid, and three hatched out. The following year, and the year after, swallows attempted to start building in my bungalow, but both times they were driven away by swifts (*Micropus affinis subfurcatus*); a "dog in the manger" action, for after the swallows had gone, the swifts themselves decided against my house as a nesting site, and went elsewhere.

More frequently nests will be found over water attached to the underside of a bridge, or jetty; and the same site is used year after year. This year, on 17th April, I noticed what at first I thought to be a single swallow, fallen into the river, and fluttering, unable to rise from the water: but it turned out to be a pair, engaged in mating. On 22nd May, there were several nests together, under the jetty, all with three eggs, except one, which had only two; all the eggs were near to hatching. More nests, each with a clutch of three, were seen in the middle of June.

The eggs are pear-shaped, slightly glossy, and very fragile. The ground colour is white, sometimes with a faint tinge of pink when unblown: they are spotted all over with brown and chocolate, the spots thickening to a ring at the larger end, where there are also some greyish undermarkings. The average size of seven is  $.69 \times .51$  inches.

**Hypothymis azurea prophata** Oberh. The Black-naped Fly-catcher.

Malay.—*name unascertained.*

A nest of this species was found on 19th April, situated forty feet from the ground, in the fork of a twig on one of the outer branches of a rubber tree, on the bank of a large main drain.

A deep cup, two and a half inches in total depth, and two and a quarter in outside diameter at the top, it was constructed of thin strips of some kind of bark, a few of which were left hanging, below the base of the nest. The outside of the nest was compacted and bound to the supporting twigs by cobwebs, and decorated with green moss. The egg chamber, which measured 1.7 inches in diameter at the top, by an inch and a half in depth, was lined with fine coconut fibre, and contained two slightly incubated eggs, measuring uniformly  $.68 \times .52$  inches. Only slightly glossy, rather pointed ovals, their ground colour is a warm cream, spotted with light reddish brown, and with some underlying spots of grey. Almost all the markings are congregated in a zone at the larger end of the egg.

**Rhipidura javanica javanica**(Sparrm.). The Malaysian Fan-tail Flycatcher.

Malay name.—Robinson gives "*merbok gila*", and translates it as "mad thrush", which is obviously an error, because "merbok" means a ground dove, not a thrush. "Merbah gila" might be meant, but "merbah" is a word applied generally to brown birds of the bulbul and babbler types, and does not fit *Rhipidura* at all. I have heard it called "*Murai gila*", by Malays, but in the local kampongs, it is best known by the name "*empak empak*" (see Wilkinson's new dictionary, Vol. 1, p. 300—"empak-empak", a bird, unidentified.)

It nests from February to June, but the greatest number of nests are found in February and March.

All the nests I have seen were between four and fifteen feet from the ground; most of them in small trees, in gardens and kampongs, two in bamboo clumps, and two in the mangroves, within a few yards of high water mark. In every case the architecture was the same. A strong tightly woven base is made round a forked twig, both legs of the fork passing through the base. On top of this is built a small cup, approximately two and a quarter inches in outside diameter at the top, the wall being a quarter of an inch thick, the egg-chamber an inch and a quarter deep, and the whole nest from rim to base only just over two inches. The materials used are dry bamboo leaves and fine fibre, with sometimes a little decayed wood interwoven in the base. The outside is very neatly compacted with cobwebs, the junction between base and nest proper being quite imperceptible. Sometimes, but by no means always, a few strands of dry bamboo leaf or other material are allowed to hang down like a tail, from the bottom of the nest. The egg-chamber is lined with fine fibre.

The eggs are always two in number, rather pointed ovals, without gloss, yellowish or greyish white, with greyish specks and blotches, mostly congregated in a zone near the larger end of the egg, and generally either sparsely distributed or absent elsewhere. My eggs measure, on average, .69 × .52 inches.

*Rhipidura*, which is a restless, fussy little bird at any time, is an extremely watchful and anxious parent. When disturbed on the nest, it never goes far away, and particularly when there are nestlings, is incredibly bold, often perching only a yard from the head of the intruder, and keeping up a constant protesting chorus of harsh grating chirps.

A pair which, after much difficulty, succeeded in raising a brood in my garden, made possible the observation of some details, which it may be of interest to record. They nested first of all in a lime tree, which was swarming with red ants (*Oecophylla smaragdina*). The second egg was laid on 18th

February: and the young birds hatched out on the 28th, an incubation period of fifteen days. They did not long survive. On 20th March the second clutch of two eggs was ready, and they were hatched on 5th April. On the 9th, I found the young birds dead, nest and corpses smothered in ants, and the parents perched on nearby twigs, very noisy and agitated.

This second misfortune caused the flycatchers to forsake the lime tree as a nesting site, and they began to build another nest fifteen yards from the first, on the slender twig of a thorny shrub, "bulang" (*Canthium* sp.). I saw two eggs, on 15th May, and again on the 16th and 17th. That night I woke, about midnight, and while I stood on my verandah heard the birds suddenly start an outcry, which lasted for a moment or two; then silence again. In the morning the eggs were gone: I can only conclude that it was the work of a tree-snake, for I can think of nothing else that could have reached the nest, so slender was the twig on which it was built.

On 26th May, there was again an egg in the nest: on the 27th, another. The first nestling hatched about 7 a.m. on 11th June, the second some three hours later. By now, the welfare of the birds and their family had become a personal matter, and it was with anxiety and later, pleasure that I watched the growth of the little creatures. Born naked but for some buffy down on head, shoulders and back, the eyes began to open and the wing quills to sprout on the fourth day. The next day quills appeared on the crown and down the back: the day after, on the tail: on the 18th the youngsters nearly filled the nest, and the tips of the wing feathers began to show. By the 21st they were well feathered and showed the white line over the eye: on the 22nd the feathers of the tail, though very short, began to fan. The nest was by now beginning to cant under their weight but happily the architecture was good, and it held firm. Until the 24th, the fledglings did not take the slightest notice when I approached the nest. The edge of their bill was pale yellow, but they must have been well fed and cared for, for I never saw them with open hungry gape, like other nestlings. On the 24th and 25th, they watched the world with keen and questioning eye: and on the morning of the 26th, fifteen days after hatching, they stood upright in the nest, tried their wings, and later in the day took their first feeble flight.

Quite apart from the value of the information gained regarding the time-table of *Rhipidura's* period of incubation, growth and development, I found the collection of these details of absorbing interest, as providing a concrete case indicating the extraordinary power of the reproductive instinct. That so small a bird, having lost two broods in one nest, and one in the second, should yet again set about the business of reproduction, and, at



long last, launch into the world her family, seems to me a set of circumstances which gives much food for thought, not only because of the persistence of the little creatures, but because of the wonderful provision of Nature which makes such persistence not only possible, but a natural instinct of the avian mind.

**Gerygone fusca sulphurea** Wall. The Sulphur-breasted Mangrove Flycatcher.

Malay name not known, except vaguely as "*kělichap pěrěpat*", which also is used in referring to white-eyes, some sunbirds, and, in fact, any bird of "*kelichap*" size found in such localities.

This little flycatcher, elsewhere rather uncommon, is found in considerable numbers in the "*perepat*" swamps on the coast near the Dindings-Perak south boundary.

I have found nests in every month from December till August inclusive, all on overhanging branches of "*perepat*" and "*api-api*" trees, at from five to twenty feet from the ground. Several nests were attached to trees right on the edge of the mangrove swamp, exposed to all the winds blowing in from the sea.

The nest is most peculiar. It is shaped like that of some kinds of sunbird; a pear-shaped bag, firmly bound at the top to a horizontal twig, and with a long "*tail*" pendent beneath the nest. The entrance, which is small, circular, and furnished with an eave, is about half-way down one side of the nest. From the supporting twig to the bottom of the nest is about four and a quarter inches, and the tail, which not infrequently is gathered and bound fairly tightly at the base, may be six inches or more in length.

The main materials used are fine fibre, tiny rootlets and various kinds of vegetable down; the egg-chamber is lined with the softest of down, and attached to its inner walls are sometimes found the breast feathers of birds: one nest was lined throughout with the breast feathers of green pigeons. The outside of the nest is decorated all over with green moss, skeleton leaves, slivers of dry rotting wood, and the white scales of some kind of sea creature. Eggs, two or three, slightly pointed ovals, without gloss, measuring on an average  $.60 \times .43$  inches. White or pinky white in ground colour, they are profusely marked all over with small spots of reddish brown, more thickly congregated at the larger end, where also are a few fine writing marks of very dark brown, almost black.

In March, I found in one nest a single egg of *Gerygone* as described above, and also an egg,  $.72 \times .51$  inches, dark olive green with a single brown blotch at the larger end, and also a zone of very tiny dark brown spots. This was probably the egg of a small cuckoo.

## NOTES ON THE NIDIFICATION OF SOME PERAK BIRDS

The nestling of *Gerygone*, when very young, is a queer little creature, clad in fine, white, hair-like feathers, which make it look like some kind of caterpillar.

Like *Rhipidura*, *Gerygone* is a watchful mother and often comes very near when one is examining the nest.

***Lalage nigra nigra* Forst.** The Pied Cuckoo-Shrike.

Malay.—*Murai batu*.

In this district, *Lalage* is found in gardens, kampong country, and in the mangroves.

I have found nests from February to June, a few on dry land, in mango or other fruit trees, and more on the coast, in the "perepat" forest. The nest is generally built in the fork of a small outer branch, and may be from twelve to thirty feet from the ground. It is a shallow saucer of coconut fibre, sometimes with a few fragments of dead leaves woven into the outside, which is covered with cobweb, this material also being used to bind the nest to the twigs on which it rests. The nest is small, only two and a half inches in outside diameter, with an egg chamber not more than half an inch deep; the head and tail of the brooding bird can be seen from below.

The eggs, two in number, are blunt ovals, not glossy. They are very pale green, profusely blotched all over with brown, and with underlying markings of pale purplish grey. Scattered over the surface are a number of small very dark brown specks, and one egg has, at the larger end, two or three fine writing marks of the same colour. The shell is exceedingly fragile. The eggs measure about  $.85 \times .6$  inches.

***Pycnonotus goiaver analis* (Horsf).** The Yellow-vented bulbul

Malay.—*mërbah kampong*.

This bird is extremely common, and its nest may be found in most gardens. It is a cup, about two and three quarter inches deep by four inches in diameter (outside measurements), made externally of bamboo and other leaves, tendrils, fibre, and occasionally small pieces of newspaper; and lined neatly, with fibre. It may be placed in hedges, bushes, the lower branches of small trees, or even in a thick tuft of lalang, at from two to twelve feet from the ground; and the nesting season here extends from January till June. The eggs, which are pinkish in ground colour, very variably marked with purplish brown and purplish grey, have an extremely fragile shell, smooth, not very glossy. The average size of a dozen eggs is  $.84 \times .62$  inches. I have not seen more than two in a clutch.

A nest built on top of a palm frond, just outside a bungalow verandah, was occupied three times in the early part of this year in January, February–March and April, though whether by the same or a different pair of birds I am unable to say.

I mentioned earlier in this paper a case of two Black and Red Broadbills, which, in spite of their comparatively large size and sturdy build, were unable to prevent the spoliation of their nest by a marauding squirrel. The bulbuls which laid the second of the above mentioned clutches were more successful. Not long before the eggs were due to hatch, a squirrel was seen approaching the nest. Both birds attacked him with such organised violence that he was driven in confusion to the shelter of a leafy tree. Not content with this, the birds kept up a furious chattering, and as soon as the squirrel, by a slight movement, betrayed his hiding place amongst the foliage, they again set upon him, and did not cease their pursuit till he had been driven right away from the vicinity of the nest.

**Pycnonotus plumosus plumosus** Blyth. The large Olive Bulbul Malay.—*měrbah hutan*.

This bulbul is not nearly so common as the last, and is of a more retiring habit. The nest, which is slightly larger and deeper than that of *P.g. analis*, is of the same type, and those I have seen were placed in low bushes, amongst the undergrowth of deserted rubber holdings, from January to June. The two eggs, averaging  $.88 \times .66$  inches, vary somewhat in shape and markings, but generally resemble those of the last species.

**Aegithina tiphia** subsp. The Common Iora.

Malay.—*kělichap kunyet*.

I have seen nests of this species in May and June. Placed on a forked twig, on one of the outermost branches of a "perepat" tree, about twenty feet from the ground, the nest is a neat cup, measuring internally two inches across by about one and a half inches deep, with walls a quarter of an inch thick, made of very fine fibre, and compacted on the outside with cobwebs, which also bind it to the twigs on which it rests.

In a nest taken on 20th May there were two eggs, one almost fresh, the other slightly more incubated. Rather pointed ovals, only slightly glossy, their ground colour was creamy white, with a faint pinkish tinge. Both eggs were boldly marked at the larger end with longitudinal stripes of reddish brown and purplish grey. One had a number of small specks and a few blotches of reddish brown over the rest of its surface; the other was very sparsely marked. They measured  $.75 \times .51$  inches.

**Mixornis gularis pileata** Blyth. The Malay Yellow-breasted Babbler.

Malay.—*měrbahimbang*.

The local Malay name, "merbahimbang", well describes the habit of this little bird. "Bimbang" is defined as meaning "anxious, uncertain, irresolute, nervous;" and anyone who has watched *Mixornis* will agree that the description is apt. On a

low branch, in scrub, or on the ground amongst fallen leaves, it is for ever turning, dodging, jerking, spreading and closing its tail, and uttering a low chattering "chirr".

My first note of its breeding season is on 12th February, when I saw an adult bird accompanied by a newly fledged juvenile. Later on, I found nests in February, March and April. All the nests were in secondary jungle or thick scrub; one actually on the ground, another just above ground level, and a third three feet from the ground, in a palas tree (fan-palm, *Licualas*). The nest in each case was a small pad of coconut fibre, loosely made and protected by an equally loosely woven dome of bamboo leaves, or dry lalang and a little grass, in one instance. One nest contained three eggs, another two, partly incubated; a third, two young birds. The third nest, which was in fairly thick secondary jungle, was discovered quite by chance. On my way along the path I disturbed a small owl, *Otus* sp., which, when it flew near the babbler's nest, was set upon and mobbed by the parents, and later by a collection of other small birds, with such a noise and fuss that I thought there must be some special reason for it, and so searched round, and found the nest.

The eggs, which measure about  $.71 \times .5$  inches, are ovals, somewhat pointed, and glossy. The ground colour is white, spotted with reddish brown. Sparsely distributed at the smaller end of the egg, the spots are, at the larger end, congregated into a zone, and have underlying them a few spots of a pale purplish shade.

On 5th April, a *Mixornis* was brought in, said to have been shot at a nest which was in a position similar to those found by me, and constructed of the same materials, except that fine rootlets were used for the pad instead of coconut fibre. The eggs, however, were quite different. Measuring about  $.75 \times .57$  inches, they were rather rounded ovals, glossy, pale green, heavily marked all over with spots and blotches of a warm reddish brown, and with the usual purplish under markings, particularly at the larger end.

I understand that *Mixornis* has, by other observers, already been noted as laying two types of egg; but as on this occasion I was not present when the parent was shot, I give the record with reserve.

*Copsychus saularis musicus* (Raffles). The Straits Robin.  
Malay.—*murai*.

It is almost unnecessary to write a note on the nesting habits of a bird so familiar to Malayan residents as is the "murai".

It nests from February to July. The usual clutch is three, sometimes four. The eggs are blue-green, thickly marked with various shades of brown, the size and distribution of the

markings varying considerably even in the same clutch. Rather glossy, somewhat rounded ovals, those I have measured average  $.92 \times .70$  inches.

The nest may be situated almost anywhere not very far from human habitation. Of the very large number of nests I have seen, only a few were in bushes or hedges; some were under the eaves of a house, a number in shallow holes in trees, or in a depression at the top of a rotting stump, and an equally large number at the junction of frond and stem of coconut or other palms at any height from three to twenty feet from the ground. One nest was made in a cooking pot, coloured black and white and upturned on a pole, to act as scarecrow in a Tamil squatter's kitchen garden; another, on top of a growing bunch of bananas, four feet from the door of a squatter's hut.

If the bird is allowed to bring up its family without disturbance, the same site is often used in successive seasons, or twice in the same season.

When made in holes, or in a palm, the nest frequently consists of only a few strands of coconut fibre; elsewhere, it is usually a large untidy structure of grass, roots and dead leaves, lined with fibre, with which are very often interwoven a few bullock or buffalo hairs.

**Orthotomus atrigularis atrigularis** Temm. The Black-necked Tailor-Bird.

**O. sutoria maculicollis** Moore. The Long-tailed Tailor-Bird.

**O. sepium cineraceus** Moore. The Long-tailed Tailor-Bird.

Malay.—*laki padi* (vaguely).

These little warblers are well known because of the ingenious method by which they sew their nests to growing leaves.

I have found nests of *O. atrigularis* in February and March. The first nest found was in an abandoned kampong, in a low bush, about three feet from the ground. This nest, which was a pouch of fine grass, lined with the same, and ornamented on the outside with a few blobs of green and white vegetable down was sewn to the two drooping leaves between which it hung by a material which was, I think, cobweb twisted into threads. It measured about three and a half inches in total depth, and two and a half inches across at its broadest. The egg-chamber was about two inches deep, and contained four eggs, pale greenish blue, with fairly large blotches of pale rufous, and some small dark brown specks and scriggly markings at the larger end. Somewhat glossy, rather blunt ovals, they varied slightly in size, from .62 to .68 inches in length by a uniform .45 inches in breadth.

Another nest, found twelve feet from the ground in a horse-mango tree (*Magnifera foetida*), close to a Malay house,

was similar in size, and hung between two leaves as before, but was constructed almost entirely of cotton-down, which material was also used for the sewing. Here and there, particularly at the nest rim, were a few strands of fine, dry grass and a little green down; but seen from below, the body of the nest looked exactly what closer examination proved it to be, a thick pouch of tree-cotton.

My nests of *O. s. maculicollis*, found in February, April and May were of a different type. Between three and five feet from the ground, each was sewn into a single large leaf, which hung from the plant at an angle of forty-five degrees, the midrib of the leaf forming the approximate centre of a sloping roof to the nest.

The birds had made several false starts, and I was able to deduce to some extent the method of working. It seems that the bird first chooses a large soft flattish leaf, pulls down the outer edges, and sews them together with strands of cotton or other down, drawn through holes which have been pierced in the edges of the leaf, and secured by knotting the sewing material into little blobs, bigger than the sewing holes. Where work on a leaf had been abandoned, it seemed generally to be because the holes had been made too near the edge of the leaf, and had torn when a strain was put on them.

The nesting material, in this case very fine grass, is then brought, and a compact, tidy little nest is constructed. The *O. s. maculicollis* nests are about three and a half inches deep overall, (the egg-chamber about two and a half inches inside depth), and six inches in circumference at their largest. The lower wall and bottom of the nest, are thick; at the back, there are only a few strands of grass, up against the leaf. Here and there, a strand is drawn through the leaf, and fixed in position by a blob of down; and finally, the broadest portion of the nest, showing between the edges of the leaf where these are about an inch apart, is ornamented with some green vegetable down.

The clutch is either three or four. The eggs are very like those of *O. atrigularis*, but nine specimens average slightly smaller, .63 by just under .45 inches.

A nest of *O. s. cineraceus*, found in January, 1932 was very like those of *O. s. maculicollis* above described, if anything rather more compact and carefully made. It contained two eggs, just beginning to incubate, marked like those of the other species, but with the ground colour a very pale green, with just a tinge of blue. They measured .61  $\times$  .42 inches, and the small end was rather pointed. In April, however, I took two nests of a third type. Both were three or four feet from the ground, sewn into large leaves, but the nests were small cups, about two and a half

inches in total depth, made externally of fibrous material, much coarser than usual, and much less neatly put together. One nest was profusely, the other lightly lined with soft white down, and the outside of both was ornamented with some of the green material used by the other species.

One clutch of two eggs, beginning to incubate, measured .65 and .63  $\times$  .42 inches, the colour was creamy white with spots and blotches of reddish brown, more thickly congregated at the larger end, and with a few underlying purplish markings; the other clutch, also consisted of two eggs, slightly longer (.67  $\times$  .44) and more pointed, pure white, with small specks of brown and purplish brown, most numerous at the large end of the egg, sparse elsewhere. These eggs were also partly incubated. Finally, a clutch of three, in January, 1933, were pinky white in ground colour, more or less evenly marked all over with numerous small spots and flecks of reddish brown, and, at the larger end, a very few underlying markings of pale purple. They averaged .62  $\times$  .42 inches, and were long ovals, slightly pointed, and rather glossy.

I have set down my notes on the nests of these birds as a starting point for further observations, to find whether the different types of nest are specific or due to individual idiosyncrasy; and whether eggs of other species vary as much as do those of *O. s. cineraceus*.

**Burnesia flaviventris rafflesi** (Tweed.). The Yellow-bellied Wren-Warbler.

Malay.—*laki padi*.

Nests of this little warbler were found from January to June. All were situated in thick lalang, and were one and a half to two feet above the ground. The nest is not attached to the lalang, but merely built between the stems, which at that height from the ground are sufficiently strong to bear its light weight. It is usually a loosely constructed ball, about the size of a large orange made of dry bamboo and lalang leaves, interwoven with fine grass, which material is also used for lining the egg-chamber. One nest had on the outside wall, a piece of sloughed snake skin. The entrance is roughly circular, placed centrally on one side. Occasionally more carefully constructed nests may be seen. One on which I have notes was built externally of fine stems of dry grass, some with the flower-heads still attached, fibre, and lalang heads, compacted here and there with a little cobweb: internally it was lined, very neatly, with fine fibre.

The clutch is three or four, generally, in my experience, three. The eggs, which are rounded ovals, and extremely glossy vary little in size, most eggs being about .59  $\times$  .46 inches but

I have one egg measuring only  $.55 \times .43$  inches. The colour is most unusual. At the larger end there is a cap of rich reddish chestnut, shading to a paler colour on the rest of the egg. Eggs vary a good deal in depth of tint, and light and dark coloured eggs may be found in the same clutch. Their peculiar colour and extremely high gloss make them look more like reddish beads, than birds' eggs.

**Cisticola juncidis malaya** Lynes. The Malayan Grass Warbler.

Malay.—*laki padi*. This name is given to any small bird of the warbler type, which frequents grass and lalang land.

Several nests were found from February to May.

The nest is very flimsy, purse-shaped, and three to four inches deep overall, the inside depth of the egg-chamber being one and a half to two inches. The nest rim is often noticeably higher at the back of the cup.

The materials used are dry lalang, very fine dry grass and lalang flowers, mainly the latter, which alone are used for lining the egg-chamber. The nest is placed amongst low lalang from six inches to two feet from the ground, attached to and supported by some of the young blades, which are bent over and interwoven with the dry nesting material.

One or two eggs are laid, white, with a greenish tinge, marked all over with minute brown specks, most numerous at the larger end, where also are some very faint underlying greyish markings. Oval, slightly compressed at one end, the egg measures about  $.63 \times .45$  inches; for so small an egg, it has a relatively tough shell, with a slight gloss.

**Corvus coronoides macrorhynchus** Wagl. The Southern Large-billed Crow.

Malay.—*gagak*.

I have seen crows' nests in the mangroves, in January, forty to sixty feet from the ground, and containing four or five eggs.

On 12th March I took a nest, which was built on top of an isolated tree sixty feet high, near a main road. The nest was a pile of sticks two and a half feet in total depth by about two feet across, the egg-chamber being about a foot deep, lined with strands of coconut fibre, and a few human hairs.

Four eggs, just beginning to incubate, varied in length from 1.62 to 1.76 inches, and in breadth from 1.15 to 1.2, averaging  $1.69 \times 1.19$ .

Pointed at one end, not glossy, they were of a blue-green ground colour, heavily marked with brown, dark brown, and some small spots of almost black, the markings being spread all over the egg, but most heavily congregated at the larger end.



**Dicrurus longicaudatus intermedius** Blyth. The Long-tailed Drongo. Malay.—*chěchawi*.

This drongo, which has hitherto only been recorded from as far south as Alor Star, was in 1932 discovered to be breeding in Sitiawan. It seems probable that it is only a summer visitor to the district: I have no record of its occurrence except during the breeding season.

On 13th April I found a nest, forty feet from the ground on a small horizontal outer branch of a rubber tree.

Considerable difficulty was anticipated in getting the eggs, but a Javanese, who has a local reputation as a climber, was called into consultation. He first supported the branch which held the nest, by roping it to a stout branch higher up the tree; then, having tied one end of a second rope to the same stout branch, he walked gingerly out towards the nest, taking as much of his weight as he could on the rope, with one arm. It is not surprising that by the time he reached the nest, his hand shook somewhat, so that one of the eggs was dropped. The other two he brought to safety, in his mouth!

The nest is a shallow saucer, placed in a fork, with part of the rim overlapping the arms of the fork on both sides, so that the nest hangs like a cradle. It is only about four inches in external diameter, and an inch deep—a very small nest, considering the size of the bird. This nest was made of *akar sepuleh*, a creeping plant, with small, flat leaves, found growing on rubber trees, usually at a fork. Some of the leaves were left on the stems used to make the nest, but most of them had been picked off.

The floor of the egg-chamber is loosely woven, and in some cases the eggs can be seen from below; the rims which bear on the supporting branch, are strong and well made. The outside of the nest is compacted and adorned with cobwebs, green moss and lichen.

There were three eggs, partly incubated, measuring  $.9 \times .72$  inches. Smooth, not glossy, rounded ovals, the ground colour is a beautiful pale pink, marked sparsely all over with small brown spots, and with larger blotches of brown and purplish brown, underlaid with pale purplish grey.

Four other nests were noted, in May and June. All these were found twenty to thirty feet from the ground, in outer branches of "perepat" trees.

This and other drongos often draw attention to the existence of their nests by their habit of swooping at the heads of passers by. The nest described above was first brought to my notice by a report from a rubber tapper, who was disturbed

## NOTES ON THE NIDIFICATION OF SOME PERAK BIRDS

in his work by the antics of the birds, whenever he approached the tree in which they had their nest.

***Aplonis panayensis strigatus*** (Horsf.). The Malay Tree-Starling.

Malay.—*përling*.

The glossy starling is not a common bird in this locality but may be seen in kampong country, feeding on the berries of certain trees.

All the nests I have seen were in the mangroves, generally very high up, in rotten branches of "perepat" trees, so that although birds were frequently watched carrying nesting material, it was a long time before I found a nest in an accessible position.

Nesting took place in March and April. On 26th April I was able to obtain a clutch. Twenty-five feet from the ground, a large "perepat" branch had broken off, and at the end of it a hole extended horizontally inwards for eighteen inches. In this hole was the nest, a large untidy collection of dry serdang leaves (a fan-palm, *Livistonia cochinensis*), straw, bits of rope and other rubbish; the eggs were laid on a pad of green leaves of the jawi-jawi tree (*Ficus rhododendrifolia*) torn in pieces and arranged to line the egg-chamber.

There were three eggs, quite fresh, and somewhat glossy. They varied remarkably in shape, and also in distribution of markings. All were alike in ground colour, a beautiful blue, with a tinge of green. One egg, measuring .99 × .68 inches, was a blunt oval, blotched and spotted all over with pale brown and purplish brown. Another, which measured 1.03 × .71 inches was very pointed at one end, the blotches bolder and more chocolate in colour, almost all at the large end of the egg; and the third, 1.1 × .69 inches, was very elongate, but not sharply pointed at the small end. The markings, in this egg predominantly purplish brown, were, with the exception of an occasional speck elsewhere, entirely confined to a small cap at the large end of the egg, where they almost obscured the ground colour.

***Gracula javana javana*** (Cuv.). The Malay Grackle.

Malay.—*Tiong*.

This bird nests from December to May.

On 19th March, I found a nest. The parent bird was seen leaving a hole, forty feet from the ground in a large "perepat" tree. The hole was wide enough to admit my man's hand and forearm, but had to be widened, with a small axe, to enable him to reach the bottom of the nest, which was two feet lower than the entrance.

The chamber was lined with a few twigs and some coconut fibre and contained two young birds not long hatched.

Another nest, similar in all respects, was found, on 24th March, to contain a single nestling.

On 2nd May it was discovered that the same, or another pair of grackles, had gone back to the first nest, and two eggs had been laid, which, when I obtained them, were just beginning to incubate. This time the nest lining was not coconut fibre, but a few green "perepat" leaves.

The eggs, which measured 1.4 and 1.45  $\times$  .97 inches were ovals, slightly compressed at one end, and somewhat glossy. Their ground colour was pale blue, rather sparsely spotted with light chocolate and undermarkings of a very pale purplish tinge, most of the spots being at the larger end of the egg. Another clutch, taken on 23rd December, averaged slightly larger (1.48  $\times$  .99 inches). The eggs were long and pointed, marked, as in the previous clutch, with indistinct spots of pale purple, but with only a few very tiny specks of brown.

**Aethiospar fuscus torquatus** (Davison). The Buffalo Myna.  
Malay.—*gëmbala kërbaü*.

This attractive little starling is not uncommon here, being found in small parties in kampong country and near grazing grounds. Its Malay name, which means buffalo herdsman, is of course derived from its habit of perching on the backs of cattle, no doubt to feed on their insect parasites. I have watched parties of birds on the atap roofs of Malay huts, apparently searching for insects in the thatch; and they are frequently seen on the ground. When disturbed the birds generally fly up to one of the fronds of a nearby coconut palm. Occasionally I have seen flocks of thirty or forty birds, perched on dead trees, and keeping up a continuous chattering chorus. They hardly ever perch on living trees.

The nesting season is from February to May.

I have seen three nests in holes eighteen to twenty feet from the ground, in branches or trunks of dead "perepat" trees. In both cases, when I was able to examine such nests, the eggs were laid on a scanty lining of small twigs, at the end of a horizontal tunnel about a foot in length, probably the deserted nest hole of some other bird.

A much more favoured site, however, is the crown of a tall coconut palm. One nest, where the bird had chosen a natural hollow at the base of a frond, was rather neatly made of dry grass, fibre and tendrils, and the egg chamber, which was about six inches in diameter, was lined with a few green leaves of a fig tree. Others, also in the tops of coconut palms, were large untidy collections of all sorts of rubbish—twigs, rootlets, dry

grass, feathers, tinfoil, and paper cigarette wrappers; and lined, quite neatly, with coconut fibre.

I saw a nest in a coconut palm near a Malay house, on 7th February, which then contained five nestlings. The owner of the house told me that the same site has been used time after time, and indeed, at the end of March, I happened to pass the place just in time to see a crow carry off a nestling from the second brood!

The clutch varies from three to five. The eggs are glossy, pointed, and measure usually about  $1.0 \times .8$  inches: but I have two exceptionally large eggs, long oval in shape, measuring  $1.19 \times .86$ , and  $1.22 \times .85$  inches. Their colour is a beautiful greenish blue, without any markings.

**Passer montanus malaccensis** (Dubois). The Malay Sparrow.

Malay.—*pipit rumah*; *lochok-lochok*.

The nest of this bird must be familiar to everyone. Most houses contain a few of those untidy piles of rubbish, lined with feathers, in which are laid four to six eggs, generally dull and glossless but sometimes with a slight gloss and whitish to greenish grey, very variably marked with spots and blotches of different shades of grey and brown. Some eggs are almost white, quite sparsely spotted: others are so heavily infuscated that the ground colour cannot be distinguished. The average size of twenty eggs is  $.76 \times .56$  inches.

I dislike the sparrow, and discourage him as much as I can. His noisy quarrelsome habits drive other birds away, and when he can, he steals nesting material from the partly constructed nests of more welcome visitors. In an endeavour to lessen the sparrow population of my house and compound, I have of late years destroyed their nests whenever possible, and to give the birds their due, they display remarkable ingenuity in discovering sites which are sufficiently inaccessible to be safe from my interference.

**Munia maja maja** (Linn.). White-headed Munia.

(*pipit kēpala putēh*).

**M. atricapilla sinensis** Blyth. Black-headed Munia.

(*pipit kēpala hitam*).

**M. punctulata fretensis** Kloss. Spotted Munia.

(*pipit pinang*).

**Uroloncha striata subsquamicollis** Stuart-Baker. Sharp-tailed Munia.

(*pipit hitam*).

The Java sparrow (*Munia oryzivora*) occurs very rarely in this neighbourhood. Two or three times only in the course of

years, I have noted a pair, or a party of three, which appeared, were seen daily for a week or so, and departed as suddenly as they had arrived.

The four weaver-finches mentioned above all build fairly large globular nests, with an entrance at the side, and lay unspotted white eggs.

Nests of *M. maja* may be found in any month of the year, in bushes, hedges, trees, palms, inside a large canna leaf, or even in pineapple beds, at any height from two to fifteen feet from the ground. They are loosely constructed of coarse grass and bamboo leaves, lined with finer grass, and the usual clutch is five or six. Eggs measure  $.64 \times .47$  inches, and are without gloss, but slightly translucent when quite fresh.

This is by far the commonest species, the second being *M. atricapilla*, which is much less of a garden bird, but at certain times of the year joins with *M. maja* in great flocks, and becomes one of the worst plagues of the padi planter.

All the *M. atricapilla* nests I have found have been in lalang or low bushes, from nine inches to four feet above ground level, between January and May. The nest is generally made of rather finer grass than that employed by *M. maja*, and the flower-stalks of lalang are also largely used. In quite a number of nests, the ends of grass stems are left projecting about an inch, forming a sort of eave over the entrance hole; and this is also done by *Uroloncha*. *M. atricapilla* sometimes nests more or less socially. On several occasions I have found four or five nests within a ten yard circle, in a lalang plain. The full clutch is generally five, and seventeen eggs average  $.64 \times .46$  inches.

*M. punctulata fretensis*, as implied by its Malay name, frequents palms of the areca and sealing-wax (*Cyrtostachys lacca*) type; and all nests I have seen have been in the tops of such palms, and at a height of twelve to eighteen feet, between February and May. They appear to be rather more neatly made and tightly woven than those of the previous species. The usual clutch is four or five, and eggs measure about  $.61 \times .43$  inches: there is sometimes considerable variation in the size of eggs within a single clutch.

My *Uroloncha* nests, on the other hand, have all been on fruit trees, between seven and twelve feet, generally not far from the outer end of a branch. Made externally of grass, dry leaves and bamboo, they are neatly lined with fine soft grass, and again five seems to be the normal clutch, eggs averaging  $.6 \times .42$  inches. I have found nests only in January and February, but probably the nesting season is extended beyond these limits.

***Ploceus passerinus infortunatus* Hart.** The Malay Weaver-finch.

Malay.—*burong tēmpua*.

The extremely interesting and amazingly well constructed nests of this species, and the half nests, provided with a cross bar, which are said to be used as perches or swings by the males, have been described by several observers, and I intend to record here only such of my observations as do not quite tally with notes on the nidification of *Ploceus*, as given in Robinson's Volume 1.

I have seen a large number of nests in January, and others, not so numerous, from February to June. Most of the nests hung from small trees in "belukar" and "lalang", a few from bamboos and coconut fronds; in every case except one, the surroundings of the nest were infested with red ants (*Oecophylla smaragdina*). Most of the nests were lined with the light downy seeds of lalang, and one nest contained a single wing feather of—I think—a rail. The clutches were four, five, and six. The eggs are white, oval, long and pointed. Measurements of sixteen eggs vary from .91 to .78 in length by .6 to .54 in breadth, and average  $.82 \times .57$  inches.

***Anthus richardi malayensis* Eyton.** The Malay Pipit.

Malay.—*tēmpua tanah*.

A familiar little bird, common everywhere on lawns and dry grass land.

The nests may usually be found, in this district, from February to April, situated on the ground, in short grass or lalang, generally placed in a small natural hollow, which is lined by the bird with dry grass, lalang and small rootlets, tightly compacted into a pad about an inch thick and five inches in diameter, curling upwards at the rim; the back and sides are protected by a loosely woven wall of the same materials, which not infrequently forms a complete dome about five inches higher than the nest proper, and with a roughly circular entrance two and a half to three inches in diameter. Interwoven with the padding of the egg-chamber are always found a few hairs from the tails of cattle.

The clutch, in my experience, is generally three, occasionally four. The eggs are greyish white, sometimes faintly tinged with green or purple, and vary within the same clutch, both in shade of ground colour and as regards size, boldness, and distribution of markings, which may be almost confined to a blurred zone at the larger end of the egg, or very evenly distributed all over, and of widely differing shades of brown, greyish brown and purplish black. Some eggs are rather pointed, others much rounded. The average size of seven is  $.78 \times .6$  inches.

Quite often I have found stray eggs on the golf course, on lawns, and once on one of the firing points of a rifle range.

**Chalcostetha calcostetha calcostetha** (Jard.). Macklots' Sunbird.

Malay.—*kēlichap hitam*.

I have found nests of this sunbird from January to June, none in the mangrove belt, but all in, or on the edge of scrub, near the sea.

The nests are often placed in singularly exposed positions, always on the outside of a bush or prickly stemless palm, between two and five feet from the ground. They are of the usual sunbird type, a roughly pear-shaped bag, hanging by its smaller end from a twig or palm frond. The total length of the nest is about five inches, its outside circumference at widest about seven inches. The entrance hole, which is in the top half of the outward side of the nest, is oval, and about one and a half inches vertically by one inch across. The depth of the egg chamber is about one and a half inches, measured from the lower rim of the entrance hole, which is protected by a small eave.

The bottom of the nest is fairly solid; the rest is somewhat loosely woven, very fine grass and fibrous material being used, and on the outside, bits of dry bark, and fragments of bamboo and palm leaves, some of which are allowed to hang down loosely. The materials used give the nests of this species a characteristic dingy brown, untidy appearance. Occasionally cobwebs are sparingly used to compact the outside nest wall, which may also be decorated with a little green moss.

The clutch is two. Usually the ground colour is a pale sienna brown, profusely overlaid with a slightly darker shade, the markings coalescing at the larger end into a zone of much darker and warmer colour.

Some eggs, however, are dingy grey, the ground colour being much obscured by a profusion of tiny markings of dull brown, especially at the larger end. Such eggs seem to be smaller than those first described, mine averaging  $.6 \times .45$  against  $.63 \times .45$  inches. Somewhat pointed ovals, they are highly glossy.

**Anthreptes malaccensis malaccensis** (Scop.). The Brown-throated Sunbird.

Malay.—*kēlichap kāmpong*.

The nesting season of this species, in this locality by far the commonest of the *Nectariniidae*, extends certainly from January to July inclusive, probably longer. I have found nests in these and all the intervening months, the greatest number being in January and February.

Curiously enough, I have never found a nest in the situation which Robinson gives as the most usual one, *viz.*, hanging from the end of a leaf of a coconut or betel palm. A number of nests were in mango trees, between ten and fifteen feet from the

ground; as many more in bushes, in scrub, from five to eight feet; one twenty feet from the ground in a rubber tree, several, on the coast, in low baru trees (*Hibiscus tiliaceus*); and one in the mangroves, forty feet from the ground in the top of a young perepat tree. This last seemed to me remarkable, both by reason of the height and situation, and because out of some twenty-five nests examined this season, it was the only one not placed in a site already infested by red ants.

The nest is of the same pear-shaped type as that of *Chalcostetha*, slightly less in depth and a little larger in circumference. The entrance hole is rather larger and has a much more pronounced eave. The walls are thin, but the inside is well lined with lalang down. Some cobweb is used on the outside, and a few of the usual slivers of wood, bits of dry bark, and so on, ornament it; but the nest has a much more tidy appearance than the last described. Generally great care seems to be taken in making firm the lower rim of the entrance, on which the bird lights for a moment before entering the nest. In almost all nests this rim is tightly and strongly woven.

Two eggs are laid, glossless, rather pointed ovals. They are pale lilac grey, heavily blotched all over with lavender grey, and with numerous fine scribbling marks of purplish brown and purplish black. There is a certain amount of variation in shape and density of markings even between eggs of the same clutch. Eggs I have measured, varying from  $.75 \times .5$  to  $.67 \times .45$ , average  $.70 \times .49$  inches.

*Leptocoma jugularis pectoralis* (Horsf.). The Yellow-breasted Sunbird.

Malay.—*kělíchap*.

A nest of this species was taken on 11th March, in a low coconut palm, near a Malay house. Nine feet from the ground, one of the leaves of an overhanging frond had been selected, and the midrib stripped bare of leaf for about eighteen inches of its length, six inches or more at the tip being left in its natural state. The nest, and its extensions above and below, were firmly bound to the midrib, with fibre, moss and a little cobweb, for the whole eighteen inches, giving the impression of a bunch of kampong refuse caught by and dangling from the frond.

The nest proper was an inverted pear, four inches from top to bottom, the entrance furnished with an eave. The whole inside of the nest, and the eave, were thickly lined with soft cotton down, and the flimsy transparent outer wall of fine fibres only served to hold the downy lining in shape. The top of the nest was continued as a narrow cone, for four inches above the eave, tapering to a point just where the stripping of leaf from midrib commenced; below the nest there was a long tail, quite ten inches,



made of slivers of decaying wood, pieces of dry coconut leaf, bits of bark, and combings from the hair of some kampong lady. The whole structure from top to tail tip, was decorated with wood refuse, blobs of down, strands of sewing cotton, skeleton leaves, green moss, spider castings and fragments of other kampong rubbish.

Two other nests were seen, on 20th April and 30th May. One was about six feet from the ground, dangling from the end of a low perepat branch; the other only three feet from the ground, in a very exposed position, hanging from an outer branch of a prickly bush, (*Canthium* sp.). On this bush were also two incomplete nests of the same species, probably unsuccessful attempts to reach the standard of perfection desired by the birds. Both finished nests were very much the same as that described above, not quite so generously lined with cotton down, and the outside decorations varying according to what particular kind of refuse was most easily obtainable in the locality.

A nest found in the following December was lined with the breast feathers of a bulbul, and had, amongst other decorations on the "tail", a wing feather of a snipe. This nest, like the previous ones, was near ground level: but on 23rd February I saw a nest thirty feet up dangling from the outer branch of a rubber tree by a single strand of strong fibre: and still stranger was the situation of a nest in March—firmly bound to a roadside telegraph wire! Both the last mentioned nests, for obvious reasons, were furnished with only a short "tail": the decorative tendency of the builders had to be sacrificed to the safety of their nests.

The eggs are pale green or greenish white, blotched with dull brown and dull purplish grey, with some tiny specks, and, at the larger end, some short, very fine writing marks of very dark brown, almost black. Some eggs have the brown and grey markings fairly evenly distributed, others being more heavily marked at the larger end. Pointed ovals, without gloss, they measure about  $.60 \times .43$  inches.

***Dicaeum cruentatum ignitum* (Begbie).** The Scarlet-backed Flower-pecker.

Malay.—*Sěpah putěri*.

In an abandoned rubber holding, grown up in lalang and bushes, I found both this and the following species, in considerable numbers. Most of the trees carried heavy growths of *Loranthus*, a parasitic plant of the mistletoe type. Flower-peckers are very fond of *Loranthus* berries, and are said to play a large part in spreading the growth to unaffected trees, by depositing the viscid seeds on a branch, to which they adhere, and finally take root.

The nest is a most delicate structure, and is rather difficult to find, being very small, and frequently placed at some height from the ground, at the end of a lateral branch, in the centre of and concealed by the terminal bunch of leaves.

I took a nest on 10th March, twenty feet from the ground. It was an egg-shaped pouch, three inches in total depth, with a maximum girth of five and half inches. The entrance hole, which was roughly circular, and about an inch in diameter, was placed in the top half of the outward side of the nest. The attachment of the nest to its supporting branch was firm and well made, very fine fibre being used, the entrance rim was a tightly woven rope of the same material, which was also used, but sparingly, to bind together the body of the nest. This was constructed and lined with the whitest of lalang down; the walls were thin, but the egg-chamber was thickly lined and of an exquisite softness. To the outer wall of the nest, by way of decoration, were attached two or three slender strips of thin bark.

It contained a single egg; a long oval, slightly compressed at one end; greyish white, and glossless. It measured  $.59 \times .41$  inches, and was just beginning to incubate. The clutch may be two, for a nest seen in January contained that number of eggs.

**Dicaeum trigonostigma trigonostigma** (Scop.). The Orange-bellied Flower-pecker.

Malay name.—*sěpah putěri*.

Nests of this species, seen in March, each contained a single nestling.

Placed, like those of *D. c. ignitum*, at the end of branches, these nests were only eight feet from the ground, one attached to a young rubber tree, the other to a bushy shrub, growing in the "belukar" not far away. The shape and construction of the nests is much the same as that of the last described, but they are rather more compact, a somewhat greater amount of fibre being used to bind the outer walls and egg-chamber, to the lining of which, besides lalang down, a little cotton down is added. The extra-mural decorations take the form of a little green moss and the dried excreta of caterpillars. The entrance hole, instead of being circular, is long and oval, one and a half inches from top to bottom, and hardly more than half an inch across at its widest.

**Zosterops palpebrosa williamsoni** Rob. and Kloss.

The Malay White-eye.

Malay.—*kělichap pěřepat*.

This little bird, which is extremely common here, both in the mangroves and elsewhere, builds a small neat cup-shaped

nest of fine grass and fibre, lined with still finer material, compacted on the outside with cobweb, and sometimes decorated with a little green moss. The nest hangs like a cradle in the horizontal fork of a twig, part of the rim being securely bound to each arm of the fork. A peculiarity is that in almost all the nests I have seen, a kind of mooring rope is thrown out from the rim of the nest to a third twig, often as far as two inches away. Sometimes this is only a single strand of the same material as is used for the outside of the nest, looped round the twig and brought back to the point from which it started; in other cases several strands are woven together into a regular cable, an eighth to a quarter of an inch thick.

I have examined a large number of nests in "perepat" and "api-api" trees, from five to fifteen feet from the ground; and with a glass I have seen nests high up in rubber trees, and also found several on the ground, blown down from their lofty position in a gale.

The eggs are unspotted; pale whitish blue, not glossy, they average about  $.60 \times .43$  inches, but vary considerably in size, my smallest egg being only  $.55 \times .41$ , and my largest  $.62 \times .47$ . The nesting season is extended, certainly from December till August.

The white-eye is a busy, lively little bird, never still for a moment. Its energetic habit, however, does not send it far afield in search of nesting material when some can be obtained close at hand for one day in June, I watched a pair of white-eyes busy dismantling the nest of an *Iora*, from which the young birds had flown only the day before.

## On *Anopheles baezai* n.sp., from the Malay Peninsula

By B. A. R. GATER,

KING EDWARD VII COLLEGE OF MEDICINE, SINGAPORE

Larvae of this species were originally found at Pulau Langkawi by Dr. J. I. Baeza, in 1928, and in the same year I visited the locality and reared a series of adults. Larvae and adults have since been found in Johore, Singapore Island and Selangor. Dr. F. W. Edwards kindly compared some of the original material with type specimens in the British Museum.

Imago.

Similar to *Anopheles umbrosus* Theobald 1903, but the minute apical pale bands on the tarsi of the hind leg absent.

*Female wing* (Fig. 1) usually without the pale costal interruption near termination of *Sc*, (often found in *A. umbrosus*) it being indicated only in 10 per cent. of the specimens examined. Pale areas on wing-fringe extending from termination of *R1* half-way to or as far as *R2*, and from *R3* to *R4* + 5 (*R-C-N*, Christophers and Barraud). *Sc* with a pale interruption, sometimes with an admixture of dark scales, just beyond the middle; *R1* with a small area of pale scales below the pale area on *Sc*, and at its extremity; *R2* + 3 pale, with a few dark scales, a dark patch at fork of *R2* and *R3*; *R2* with a sub-terminal pale area equal in length to the terminal dark area, otherwise dark; *R3* pale proximally, dark distally; *R4* + 5 mainly pale, with scattered dark scales, a dark area at its origin; *M* pale with scattered dark scales; *Ma* pale, *Mp* with a terminal dark area; a small area of dark scales occurs at the fork of the last two veins; *Cu* mostly pale, a dark area at its origin; *Cu1* with three small dark areas, the middle one sometimes diffuse; *Cu2* with a dark area at its apex; *An* with terminal and median dark areas.

*Male wing* usually with a pale interruption on costa near termination of *Sc*; terminal dark areas on *Cu2* and *An* absent. *Male terminalia* differ from those of *A. umbrosus* in having two setae on the dorsal lobe of the harpago (Fig. 2) and in the processes of the ninth segment (Fig. 3) being much longer. The terminalia are similar to those found in *A. hunteri* Strickland 1916, but leaflets are present on the phallosome and appear to be similar to those of *A. umbrosus*.

#### Pupa.

Some differences in the size and branching of the hairs as compared with *A. umbrosus* were observed, the principal difference between the two species being found in hair No. 5 (according to Evan's notation) which is minute and simple in this species whereas it is comparatively large and carries 4 to 6 branches in *A. umbrosus*.

#### Larva.

Fourth instar 5 to 6 mm. long. Similar to *A. umbrosus* in general appearance, but differs as follows:—*Inner anterior clypeal* hairs (Fig. 4) finely branched at tips. *Outer anterior clypeal* hairs with 11 to 17 branches. *Posterior clypeal* hairs simple or forked on one side. *Sutural* hairs with 3 to 6 branches; *trans-sutural* simple or with 2 to 5 branches. *Antenna* (Fig. 5), length 0.281 mm., greatest breadth 0.058 mm.; antennal hair long, with 13 to 21 branches, arising at over one-third the length of shaft from the base; sabre-shaped pieces at distal end unequal in length, one sharply pointed, the other with the tip notched (Fig. 6); terminal hair slender, with 2 to 7 branches, not longer

than sword-shaped pieces. *Maxillary palp* (Fig. 7) with the cone-shaped piece longer than the finger-shaped piece which is half the length of the paired pieces. *Submedian prothoracic hairs* (Fig. 8):—inner with 2 to 5 branches, shorter than outer; central with 5 to 10 branches. *Hair No. 13* (of Puri) on prothorax with 2 to 4 branches. *Hair No. 1* on mesothorax (Fig. 9) stouter, with 14 to 21 branches, arising from a fairly conspicuous root. *Metathoracic palmate hair* (Fig. 10) small, filamentous, with 5 to 8 branches. *Pleural hairs* (Figs. 11 to 13):—on prothorax the dorsal posterior with 2 to 5 branches, the ventral anterior sometimes forked; on metathorax ventral posterior with 2 to 4 branches; projections on tubercles between anterior and posterior hairs produced into short spines on each segment.

*Abdominal palmate hairs* (all filamentous), on I with 10 to 20 branches, on II small with 5 to 13 branches, on III to V (Fig. 14) larger with 10 to 16 branches, on VI and VII smaller with 8 to 10 branches. *Lateral hairs* (Fig. 15) on segment IV stout, long, with 7 to 10 branches; on V and VI shorter with 3 to 6 branches, on VII very small with about 5 branches. *Postspiracular hair* with 3 to 7 branches. *Pecten* (Fig. 16) with 6 or 7 long, and 4 or 5 (exceptionally 6 or 7) short processes. *Hair 0* (of Puri) on abdominal segments very inconspicuous.

*Type*, ♂ and ♀, larval pelt and larva in British Museum.

*Type Locality*, Pulau Langkawi, British Malaya.

In the type locality larvae were taken in stagnant pools under shade, sometimes just within the mangrove area. The water contained 250 parts chlorine (expressed as chlorides) per 100,000. Specimens taken in Johore were said to come from a tidal swamp under shade, in which the water contained 1,200 parts chlorine per 100,000. Those from Singapore were said to have been taken in water with 330 and 680 parts chlorine per 100,000. Those from Selangor were said to have been taken in a tidal drain covered with grass and coconut leaves. On epidemiological grounds there appears to be some evidence that this species may be a carrier of malaria.

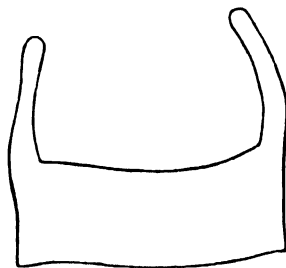
It probably has a much more extended distribution than is at present known. Specimens have been received from Selangor (*Dr. A. Devasagayam coll.*); Tanjong Agas, Muar, Johore (*Dr. G. H. Lowe coll.*) and at the 14th and 15th mile, Seletar Road, Singapore (*Dr. R. G. Spink coll.*). It is probably frequently mistaken for *A. umbrosus*, from which it can readily be distinguished in the larval stage by the branching of the lateral hair on the fourth segment.

ON ANOPHELES BAEZAI N. SP. FROM THE MALAY PENINSULA

*Anopheles bæzai* n. sp.



2

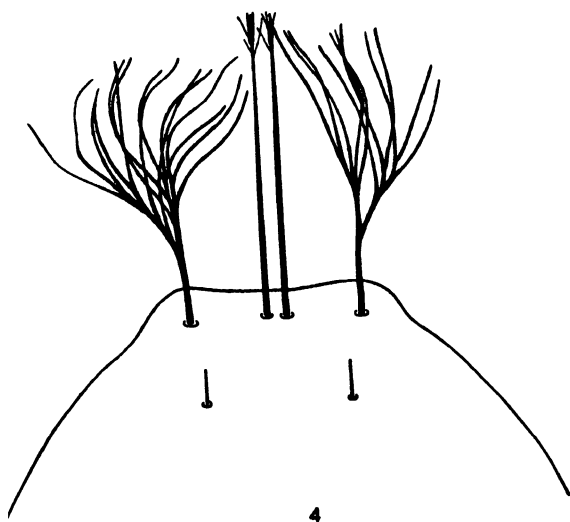


3

Female:—1. Wing. Male:—2. Harpago. 3. Processes of ninth segment.

Mus. 8, 1933.

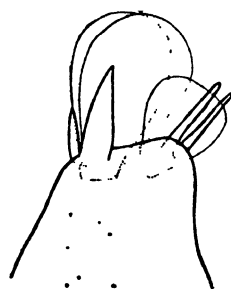
[ 165 ]



4



6



7

Larva:—4. Clypeal hairs.

5. Antenna.

6. Distal portion of right antenna, ventral view, cleared.

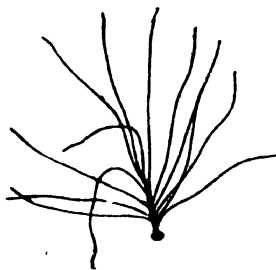
7. Distal portion of left maxillary palp, dorsal view, cleared.

ON ANOPHELES BAEZAI N. SP. FROM THE MALAY PENINSULA

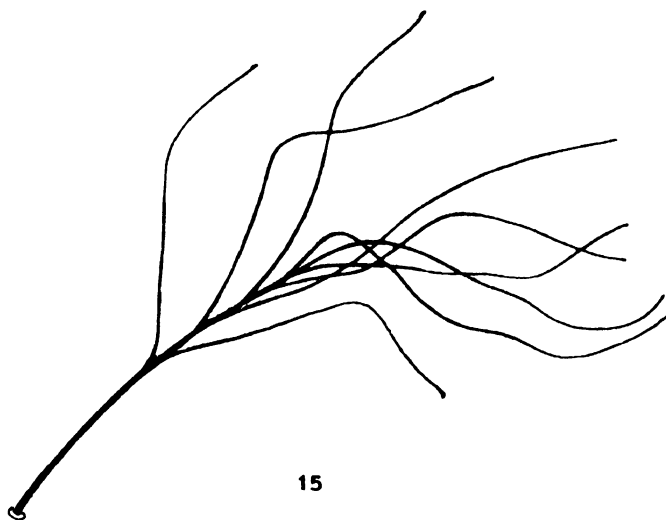


8. Sub-median prothoracic hairs, right.
9. Hair No. 1 on mesothorax.
10. Metathoracic palmate hair.
11. Bases of prothoracic pleural hairs.
12. Bases of mesothoracic pleural hairs.
13. Bases of metathoracic pleural hairs.





14



15



16

14. Abdominal palmate hair, segment IV.  
15. Lateral hair No. 6, segment IV.  
16. Spiracular pecten.

## Notes on a Collection of Malaysian Tenthredinoidea (Hym.).

By RUNAR FORSIUS, *Helsingfors*.

Mr. H. M. Pendlebury, Curator of the Museum at Kuala Lumpur, Federated Malay States, has kindly sent me for identification the collection of Tenthredinoidea of the Malayan Museums. I am very grateful to him for the privilege of studying this material as it has added much to our knowledge of the Tenthredinoidea of Malaysia. The collection which is chiefly Malayan comprises 135 specimens, representing 21 genera and 43 species. Many of these species seem to be new to science and ten are described in this paper. Of these, three cannot be placed in any known genus, and therefore three new genera have had to be made for their reception.

All holotypes and allotypes, and several paratypes have been returned to the Selangor Museum, and will be deposited in the British Museum, London. With permission of the authorities of the Selangor Museum some paratypes are retained in my own collection.

Unfortunately, the fauna of the surrounding countries is only superficially investigated and the descriptions of the already known species in many cases are too brief and insufficient to allow one to make satisfactory conclusions as to their relationship. My identification of some species recorded in this paper is therefore not absolutely certain.

Only the following species have, so far as I know, been recorded from the Malay States:

***Tremex insignis* F. Sm.**

***T. insularis* F. Sm.**

***Rhopographus procinctus* Kon.**

**"*Tenthredo*" *coxalis* F. Sm.**

**"*Stromboceros*" *albicomus* Kon.**

***Neostromboceros metallicus* Roh.**

The two last-mentioned species are probably synonymous.

Many other species are found in neighbouring countries, and some not yet known from the Malay Peninsula are widely distributed, and no doubt will be found to occur there also. It is to be hoped that entomologists in the Malay States may collect assiduously further material to extend our knowledge of the Malayan fauna of the Tenthredinoidea.

The Bornean fauna is better known. The collection of Bornean Tenthredinoidea in the Selangor Museum gives us additional contributions of great importance.

SIRICIDÆ

Xiphydriini

Genus *Xiphydria* Latr.

*Xiphydria flavicornis* Roh.

Eight males from North Borneo: Bettotan, near Sandakan, 14—21 August, 1927, C. B. Kloss and H. M. Pendlebury.

*Xiphydria erythropus* Cam.

Three females and one male from the Malay Peninsula: Selangor, Bukit Kutu, 3,300–3,500 ft., 14 March, 1931 and one male from the same locality, collected 16 April, 1926 by H. M. Pendlebury.

The male and female are somewhat differently coloured and especially the legs of the female which are not quite red but nearly unicolourous black. The puncturation of the head is also variable. I am sure that the two sexes, however, belong to the same species. The female is by Cameron named *X. melanopus*, but the male is described on the preceding page as *X. erythropus* and thus has priority.

*Xiphydria cyanea* Mocs?

One female from North Borneo: Samawang, near Sandakan, 15th July, 1927, C. B. Kloss and H. M. Pendlebury, belongs probably to this species. The specimen in question is dirty and not in very good condition and the colour not very distinctly visible, but it agrees well enough with *M. cyanea*, which species I know only from Mocsary's and Konow's descriptions. The transversoradialis is in this specimen however, interstitial with the second transversocubitalis and the specimen is only 9 millimeters in length. The abdomen is distinctly finely (transversely) coriaceous, and not punctate as Konow says ("fein und dicht punctuliert"), but rather "subtilissime punctato-coriaceus" in sense of Mocsary.

*Xiphydria indonesica* sp. n.

♀. Head ivory white; hind margin of vertex and hind orbits black; a black stripe unites the upper ends of the eyes and passes over the vertex and sends upwards a fine stripe to the hind margin of vertex, and forwards a broader stripe which is beneath divided into three small lobes and comprises the ocelli and reaches nearly the antennæ, and has below the anterior ocellus a small round ivory spot; on the clypeus an almost M-like piceous spot. Antennæ blackish. Thorax black or dark piceous; the hind and lower corners of pronotum, tegulae, a spot on the middle and two on the side lobes of mesonotum, two on the basis of scutellum, and the upper part of the mesopleuræ ivory or pale yellow. Coxæ and trochanters ivory, the first below on the

basis somewhat infuscated. Femora infuscated, the hindmost nearly black with only the knees narrowly pale. Tibiæ basally pale but on the apical half brown or black. Metatarsus ivory and only the upper end black; other tarsal joints black. Wings hyaline with piceous nervures and stigma. Abdomen piceous but on the hind margins of the segments black; second tergite on the sides and in the middle white, but these spots are in the middle narrowly interrupted, the fifth and sixth tergites have in the middle two, and on their lateral margins one transverse whitish spot; eighth and ninth tergites posteriorly margined with white; other tergites are on the undersurface on the hind corners a little paler. Basis of the sheath yellowish.

Head about as broad as thorax, on the vertex very shining and there only with some few feeble punctures, on the sides more densely punctate, above the ocelli longitudinally striated, on the front reticulated and towards the clypeus again longitudinally striated, finely and rather sparsely haired. Antennæ 16-jointed, a little shorter than head and thorax together, in the middle very slightly thickened and distinctly thinner toward the apex; first joint rather strongly curved and toward the apex thickened and about a third longer than the also curved second joint which is scarcely shorter than the third; the following joints by degrees shorter, but all joints at least twice as long as broad. Front margin of clypeus with foveæ and the tooth between these somewhat acuminate but rather short; clypeus in the middle without carina.

Thorax above rugose, especially near the sutures, and posteriorly and below furnished with rather fine and dense punctures and here more shining; (the sculpture of the thorax is partly obliterated by the stout pin); scutellum in the middle elevated, densely and coarsely punctate and opaque, on the sides sloping and here almost impunctate and very shining. Wings: the areal nervure reaches the discoidal cell in its apical fifth. Legs: hind metatarsi only slightly shorter than the hind tibiæ and about as long as the following tarsal joints together. Claws simple.

Abdomen very finely sculptured, shining, on the two first tergites besides furnished with rather strong punctures, on the second only in front; the following tergites a little more coarsely punctured in front and the two last tergites with some medium sized punctures on their apical half. Sheath seen from above a little shorter than the ninth tergite.

Length (including sheath): 11 mm. Expanse: 15.5 mm.  
Male unknown.

One single female (holotypus) from Malay Peninsula: Selangor, Gombak Valley, 20 October, 1921, H. M. Pendlebury.

Allied to *X. striatifrons* Cam. and the preceding species, but partly differently sculptured and coloured. Konow's key leads to *X. cyanea* Mocs., but the new species is much more marked with ivory white and *X. striatifrons* Cam. has reddish femora, the mesonotum marked with the same colour, etc.

### Siricini

#### Genus *Tremex* Jur.

##### *Tremex insignis* F. Sm.

One female from North Borneo: Bettotan, near Sandakan, 21 August, 1927, C. B. Kloss and H. M. Pendlebury.

The pale spots on the first and second tergites are in this specimen lacking and only the hind margins are very narrowly brownish and the whole abdomen thus practically black. *X. konowi* Lange may belong here, but the abdomen is in *T. insignis* F. Sm. also furnished with rather large punctures.

##### *Tremex insularis* F. Sm.

A defective specimen, probably female, from North Borneo: Mt. Kinabalu, Kiau, 3,000 ft., 17 April, 1929, H. M. Pendlebury, probably belongs here. The end of abdomen and the antennæ are missing.

♂. Head black with metallic sheen; an elongate spot on the lateral orbits and a small spot on the side of the clypeus reddish. Antennæ black; the two first joints, the tips of the following joints and the five last joints nearly wholly reddish. Thorax black with purplish sheen; pronotum, lateral lobes of mesonotum, scutellum in the middle, mesopleuræ and metapleuræ marked with reddish. Wings on the apical half rather dusky, the basal part from the discoidal nervure being hyaline. Coxæ, trochanters and femora purplish, the 2-7 tergites on their lateral corners and the most part of the last ventral plate reddish; some of the other ventral segments in the middle somewhat brownish.

Head densely and coarsely punctate, on the vertex and upper orbits less densely punctate and here more shining; posterior orbits only inconsiderably dilated; the hairs of the head usually rather long, but not very dense. Antennæ nearly as long as head and thorax together, 17-jointed, somewhat flattened, but only very slightly thickened in the middle; first joint scarcely longer than the third which is about as long as the fourth; second joint shorter than half the third; all joints seen from above longer than broad.

Thorax above rugose and opaque; mesonotum in front and before scutellum less punctate and more shining; scutellum posteriorly angulate; pleuræ rather densely punctate but

distinctly shining. Femora, tibiæ and tarsi flattened, the femora and coxæ rough. Areal nervure in the fore wings interstitial with the discoidal nervure.

Abdomen long, toward the end somewhat dilated, very finely reticulated and only slightly shining, rather sparsely and finely haired; the ventral plates with rather coarse but not very dense punctures last ventral plate rather convex and has posteriorly an acute, short, spine.

Female hitherto unknown.

Length 17 mm. Expanse: 25 mm.

One single male (holotypus) from Malay Peninsula: Kedah, Catchment Area, near Jitra, 4 April, 1928, H. M. Pendlebury.

Seems to me to be next allied to *T. flavicollis* Cam., whose male is so far unknown. The sexes of the known species of *Tremex* are often very differently coloured, but I do not believe that this can be the male of that species, for besides other colour differences, the female of *T. flavicollis* Cam. has yellowish hyaline wings with infuscated tips and the nervures are rufotestaceous; furthermore, the face has a triangular tooth in the middle and the scutellum is smooth.

### Genus *Siricosoma* gen.n.

Body rather robust. Head slightly broader than thorax, behind eyes very dilated. Antennæ rather long, many-jointed (in the single known female specimen 25-jointed), filiform, but somewhat compressed and in the middle not dilated; first joint more than twice as long as the second and subequal with the third which is longer than the fourth. Forewings as in *Sirex* L., but the radial cell is distally indistinctly limited and the first transversocubital nervure rises from the cubitus and is parallel with the discoidal nervure. Humeral cell in the hind wings not closed apically. Legs not very flattened. Hind tibiæ much longer than the hind femora and armed with a single spine apically. Hind metatarsus slightly longer than the hind tibiæ and also longer than the following tarsal joints together. Claws as in *Sirex* L. Ovipositor about as long as in *Sirex* L.

Genotypus: *S. tremecoides* sp. n. from the Malay Peninsula.

This new genus forms a link that in many respects unites the genera *Sirex* L. and *Tremex* Jur., and nullifies the characters hitherto used by Konow and Enslin and Rohwer to separate the families (or subfamilies) *Siricinae* and *Tremecinae*. The long, slender and many-jointed antennæ, and the four cubital cells in the forewings are reminiscent of *Siricinae*; but the basal nervure is received considerably before the middle of the discoidal cell, the humerus in the hindwings is open and the hind tibiæ are only

unispined as in *Tremecinae*. I think that the division of the *Siricidae* into other subfamilies or tribes beyond the subfamilies (or families) *Siricinae* and *Xiphydrinae* may be unnecessary. *Siricosoma tremecoides* sp. n.

♀. Head yellow; the eyes, ocelli, small spots about the ocelli, the mandibles and lower orbits black; some sutures on the occiput and below antennæ somewhat infuscated. Antennæ black; the two first joints wholly yellow and the upper part of the third joint yellowish. Thorax black, in some aspects with bluish or purplish sheen; scutellum, middle of post-scutellum, cenchri and a rectangular spot on the middle of mesonotum yellow. Wings yellowish, with the lateral and hind margins very narrowly and lightly infuscated; axillar cell in the forewings and the flabellum, with exception of its middle, in the hindwings more strongly smoky; stigma and nervures pale brownish but toward the basis of the wings more piceous. Coxæ, trochanters and femora black; tibiæ yellowish with the upper end infuscated; tarsi yellowish and only the claws somewhat infuscated. Abdomen black with a faint bluish or purplish sheen; the middle of propodeum narrowly, the second tergite on the sides and in front, the seventh tergite in the middle, the last tergite with the spine, the sides of the last but one tergite on the basis and the sheath yellow or pale brownish.

Head slightly broader than thorax, behind the eyes very much dilated, densely and coarsely punctate, opaque, but above furnished with much more sparse punctures and here distinctly shining; the hairs of the head rather long and thick, but not very dense. Vertex not very broad, toward the sides indistinctly limited and with a deep longitudinal furrow in the middle. Ocelli in a rather high triangle, the posterior ones just below the supraorbital line; OOL: POL about as 1:1. Eyes long oval and toward the mouth very much diverging. Below the anterior ocellus a rather deep longitudinal groove; interantennal space somewhat convex. Antennæ nearly as long as abdomen without spine, 26-jointed, on the distal margin of the joints and above with rather dense bristles and from the third joint somewhat flattened; the basal joints somewhat longer than broad, the middle joints seen from front about as long as broad and the apical 7-8 joints rather broader than long. Clypeus above limited by a distinct, nearly semicircular, elevated margin, in the middle depressed and with convex front margin. Malar space rather short. Mandibles robust, three-toothed.

Thorax rather densely, but not very longly haired, above very densely punctate, quite opaque; sculpture on the prothorax much more coarse than on mesonotum; lower surface of thorax with not very dense medium-sized punctures and thus somewhat

shining; prothorax with nearly perpendicular and somewhat shining front face and very acute front margin; scutellum rather flat, in the middle with a faint longitudinal furrow, nearly square. Wings of usual form; nervures in the apex of the wings indistinct; origin of the discoidal nervure nearly semi-circularly bent; areal nervure reaches the discoidal cell immediately before the origin of the discoidal nervure and is nearly interstitial with the transversohumeral nervure. Humeral cell in the hind wings outwardly open and the axillar nervure distinct. Hind tibiae a third longer than the hind femora and inconsiderably shorter than the hind metatarsus; second joint of the hind tarsi about as long as the claw-joint and inconsiderably longer than the third joint, which is nearly twice as long as the fourth.

Abdomen basally very finely reticulated and with a velvet-like appearance, rather finely and sparsely haired; the three last joints of abdomen toward the end by degrees a little more shining and furnished with coarse punctures; last joint very finely reticulated, shining, and in the middle furnished with a nearly semicircular deep impression and posteriorly with a robust spine, which is somewhat longer than the length of the segment, not growing narrower toward the basis, with a very acute spine apically and with the basal appendages proportionally well developed. The free part of the sheath about twice as long as the spine of the last tergite.

Male unknown.

Length (to the apex of the spine of the last tergite) : 28 mm.  
Expanse: 50 mm.

One female (holotypus) from Malay Peninsula, Selangor, Bukit Kutu, 3,300–3,500 ft., 18 March, 1931, H. M. Pendlebury.

## TENTHREDINIDÆ

### ARGINÆ

Genus *Cibdela* Kon.

#### *Cibdela janthina* Klug.

In the Oriental Region a common and widely-spread species which is well represented in all collections. It has certainly at least two generations yearly and is somewhat variable in respect of the colour of the wings. The specimens in the Selangor Museum collection are labelled as follows: Malay Peninsula, Selangor; Kuala Lumpur, H. M. Pendlebury, one female 15 August, 1921, three females 9 July, 1922, two females 22 July, 1922, one female 31 August, 1922, one female 1 May, 1924, one female 16 October, 1924, and one female 12 January, 1925. One female from Malay Peninsula, Selangor: Bukit Kutu, 3,500 ft., 7 September, 1929, H. M. Pendlebury. Perak: Larut



Hills, 3,700 ft., one female 9 February, 1932, one female 10 February, 1932, one female 11 February, 1932, one female 12 February, 1932, one female 17 February, 1932, all collected by H. M. Pendlebury. One female from Perak, Federated Malay States, Perak Museum, Taiping. Two females and one male from Johore: Kota Tinggi, August, 1917. Three females labelled Johore only. One female from Penang, 1,500–2,428 ft., May, 1917. Two females from British North Borneo, near Kinabalu, Kabayau, 600 ft., 10 March, 1929, H. M. Pendlebury. One female from Gardens, Singapore, 4 March, 1923, native coll. One female from Fort Canning, Singapore, 29 January, 1916, native coll. One male from Mt. Ophir, Johore, 26 August, 1905, Relau. R. Hanitsch.

*Cibdela pœcilotricha* Kon.

One female from British North Borneo, near Kinabalu, Kabayau, 600 ft., 10 May, 1929, H. M. Pendlebury.

The appendicular nervure, which issues from the angle of the third transversocubital nervure is in all specimens which I have seen rather long, and distinctly longer than in the specimens of *C. janthina* Kl. *C. pruinosa* Cam., from Borneo, has also such an appendicular nervure, but the third transversocubital nervure is in this species rather curved than angled, and the appendix is distinctly shorter. This character probably may be inconstant just as is the colour of the wings, but *C. pruinosa* Cam. can hardly be a synonym of *C. pœcilotricha* Kon. because the forewings are clouded only beyond the stigma and not wholly infuscated as in the last-mentioned species. I suppose that *C. pruinosa* Cam. may belong rather to *C. janthina* Kl. See otherwise my remarks concerning this genus in "Annalen des Naturhistorischen Museums" in Wien, vol. 46, p. 47, 1931. If *C. pruinosa* Cam. should be a distinct species, which I am inclined to doubt, the examples from Borneo mentioned above under *C. janthina* Kl. may probably belong there.

Genus *Arge* Schrank

*Arge* sp.? n.

A single male from Pahang, Federated Malay States, Lubok Tamang, 3,500 ft., 10 May, 1923, H. M. Pendlebury.

This male seems to me to represent a hitherto unknown species of the genus *Arge*, but I hesitate to describe a new species of this genus upon a single male specimen. The space between the origin of cubitus and the end of discoidalis is about as long as the length of the intercostal nervure, the antennæ are rather short and only about as long as in the European species; the hairs of the head and the mesopleuræ are pale, the hind legs wholly dark blue, the wings only slightly infuscated and only

furnished with an indistinct cloud below the stigma and costa, and other nervures piceous. All wholly metallic blue species of this genus known to me from surrounding countries have much longer antennæ and the majority of them have blackish hairs on head and thorax.

## TENTHREDININÆ

## Nematini

Genus *Pristiphora* Latr.*Pristiphora borneensis* sp. n.

♀. Head and antennæ black; only the palpi somewhat paler. Thorax black; wings rather hyaline with dark piceous nervures and stigma; basis of stigma, costa and subcosta brownish; coxæ black with yellowish apices; trochanters yellowish; front legs yellowish, the basis of femora and the tip of tarsi only slightly infuscated; posterior femora blackish with the knees narrowly yellowish; posterior tibiæ yellow with infuscated tips; middle tarsi with the two first joints yellowish, the others infuscated; hind tarsi black and only the basis of metatarsus yellowish. Abdomen black and only the upper basis of the segments somewhat brownish.

Head behind eyes much narrower than across eyes, practically impunctate and finely and rather sparsely haired, very shining. Posterior orbits rather narrow, posteriorly nearly rimmed. Vertex nearly four times as broad as long and with rather deep sidefurrows and distinct postocellar furrow. Ocelli in a very low triangle, the posterior ones just above the supra-orbital line; interocellar furrow rather deep, but narrow and ocellar basin distinct; POL: OOL nearly as 1: 1. Below anterior ocellus three diverging low crests which disappear in the middle of the front; frontal area not otherwise limited and antennal furrows in the middle interrupted. Frontal fovea superficial and elongate. Antennæ very slender and much longer than head and thorax together; first joint broader than long, much dilated apically and broader than the second, which is nearly twice as broad as long; third joint about as long as the fourth; last joint about five times as long as broad. Clypeus about five times as broad as long, in front almost straight and with distinct supraclypeal furrow. Malar space linear.

Thorax practically impunctate and finely and sparsely haired, very shining; mesopleuræ without distinct punctures; scutellum flat; praescutellar furrow nearly rectangular. Stigma rather long oval; first transversocubital nervure absent; discoidal nervure reaches the subcosta long before the origin of cubitus; first areal nervure reaches the discoidal cell in its middle. Hind tibiæ not dilated, longer than the hind tarsi and with an

indistinct longitudinal furrow laterally; hind metatarsus about as long as the three following joints together at the second joint about as long as the two following joints together; claws with a rather large inner tooth, nearly bifid.

Abdomen impunctate, very finely and sparsely haired, shining. Sheath very short and rather broad, not visible from above, but seems to be inconsiderably excised posteriorly and furnished with rather long and dense curved hairs, seen from the side very broadly rounded apically.

Male unknown to me.

Length: 6 mm. Expanse: 11.5 mm.

One female (holotypus) from North Borneo: Mt. Kinabalu, Marei Parei, 5,000 ft., 27 April, 1929, H. M. Pendlebury.

I have long hesitated to describe, and especially to name, this single somewhat defective female, but it is the first Nematini known from Borneo and the Nematini are very rare in the Oriental Region. This species recalls somewhat the European *P. melanocarpa* Htg., but the front is differently sculptured, the antennæ are slender, the inner tooth of claws are longer, etc. *P. sauteri* Roh., from Formosa, has pale pronotum and *P. formosana* Roh. has fulvous femora, the basis (?) of abdomen fulvous and the wings more dusky.

### Blennocampini

#### Genus *Corporaalinus* Forsius.

##### *Corporaalinus azureus* Forsius.

One male from Malay Peninsula, Kuala Lumpur, Bukit Cherakah, 27 July, 1921, H. M. Pendlebury.—One female from Semangko Pass, Selangor-Pahang, 2,700 ft., March, 1912, probably belongs here also, but the head is missing and the determination therefore is only a supposition.

#### Genus *Senoclia* Cam.

##### *Senoclia siametica* sp. n.

♀. Head black with blue-green sheen; clypeus, labrum, basis of mandibles and the two first joints of antennæ ivory. Thorax black with more bluish sheen; hind corners of pronotum, tegulæ and cenchri ivory white. Wings rather dusky with somewhat paler basis; forewings below stigma with a not very distinctly limited darker spot; nervures and stigma black. Coxæ blue with whitish tips; trochanters blackish; femora bluish with the knees narrowly pale yellowish; tibiæ pale yellowish with the upper ends infuscated; tarsi piceous. Abdomen with the five first segments reddish-yellow, the first in front in the middle infuscated; apex of abdomen blue-green, the sixth in the middle

reddish-yellow and the hind margin of the last tergites narrowly brownish; sheath blue-green.

Head a little narrower than thorax, behind eyes distinctly roundly narrowed, posteriorly carinated, rather finely and not very densely haired, finely and rather densely punctate, shining. Posterior orbits narrow. Vertex twice as broad as long, with very deep side furrows which toward the front become distinctly deeper, rather well elevated, but toward the front distinctly narrowed and with very strongly sloping sides; posteriorly only in the middle slightly impressed but without middle furrow. Postocellar furrow rather deep. Ocelli in a rather high triangle, the posterior ones just above the supraorbital line; POL: OOL about as 2: 5; interocellar furrow distinct, but not very deep; ocellar basin unusually deep and large. Frontal area small, not very distinctly limited and without distinct side crests; anterior frontal crest distinct, but in the middle depressed by the continuation of the very large median fovea. Eyes long oval, with only inconsiderably converging inner margins. Antennæ 9-jointed, nearly as long as head and thorax together, finely and shortly haired, toward the end somewhat thickened but then again distinctly narrowed; first joint very slightly longer than wide and about  $1\frac{1}{2}$  times as long as the second which is as long as it is broad apically; third joint very slightly longer than the fourth; the following joints by degrees shorter, all joints, however, distinctly longer than broad. Above, antennæ with distinct, oblique crests; antennal furrows above very broad. Between the antennæ a longitudinal ridge; face below antennæ very short and rather flat; supraclypeal furrow distinct. Clypeus rather long, flat, nearly twice as broad as long and with straight front margin. Labrum rather long with broadly rounded front margin. Malar space short.

Thorax rather convex, sparsely and finely haired, very finely and rather sparsely punctate, very shining, lobes of mesonotum rather strongly elevated and the furrows between them very deep, prosterna of mesopleuræ well separated; scutellum rather flat, very finely punctate, with rectangular præscutellar furrow and narrowly rounded hind corner; mesopleuræ without distinct punctures. Hind tibiæ a little longer than hind tarsi; hind metatarsi about as long as the following joints together; claws four-toothed. Forewings with very long and narrow stigma with nearly truncate apex; transversoradial nervure not parallel with the third transversocubitalis; first transversocubitalis well developed; third cubital cell longer than the second and the fourth and with nervure somewhat acuminate hind lateral corner; discoidal nervure parallel with the first recurrent and reaches costa just before the origin of cubitus; the

first areal crossvein reaches the discoidal cellule in its basal third. Hind-wings with one closed middle cell.

Abdomen very finely and rather sparsely haired, without distinct punctures or other sculpture, very shining. Sheath seen from above on basis rather narrow, in the middle somewhat dilated and toward the end rather broadly rounded and longly haired, seen from the side above nearly straight and the lower margin rather broadly rounded.

Male unknown.

Length: 11.5 Expanse: 24.5 mm.

One female (holotypus) from Rompibun, Peninsular Siam, 11 March, 1922.

At first sight this species bears a superficial resemblance to *Neostromboceros albicomus* Kon., but is easily separated from the earlier known one by the partly reddish-yellow abdomen. The new species agrees not completely with Rohwer's description of the genus *Senoclia* (Cameron's designation is rather superficial). The malar space is narrow, but not quite wanting, the hind ocelli are just above the supraorbital line, the basal nervure not interstitial with the transverse median and the hind metatarsi not longer than the following joints together. The four-toothed tarsal claws are very characteristic and I am of the opinion that it is needless to set up a new genus or subgenus for this new species.

### Selandriini

#### Genus *Neopoppia* Rohw.

##### *Neopoppia metallica* Roh.

One female from North Borneo: Bettotan, near Sandakan, 11 August, 1927, C. B. Kloss and H. M. Pendlebury.

The female of this species is hitherto undescribed. The inner margins of the eyes are practically parallel, the transversoradialis is not interstitial with the third transversocubitalis but reaches the middle of the third cubital cell and the first areal nervure reaches the discoidal cell in its first fifth. These characters are however somewhat variable. The sheath viewed from above is short, and rather broadly rounded apically, and viewed from the side, lancet-like. Length 6 mm.

I possess in my own collection an identical female specimen from Phuc Son, Annam, probably collected by Fruhstorfer (purchased from H. Rolle, Berlin). Very like *Canomades* Forsius, but the transverse humeral nervure in the fore wings is much more oblique. My *Pseudopoppia metallescens* is surely the male of *Neopoppia metallica* Roh. although not wholly agreeing with Rohwer's description.

Genus *Anapectamena* Kon.

*Anapectamena javana* Ensl.

One male from Federated Malay States; Perak, Maxwell's Hill, Taiping (or Larut Hills) 3,300 ft., 12 September, 1931, H. T. Pagden.

*Anapectamena montana* Forsius.

One male from Federated Malay States: Selangor, Kuala Lumpur, 12 July, 1931, H. M. Pendlebury.

*Anapectamena jacobsoni* Ensl.

One male from Federated Malay States: Perak, Larut Hills, 4,500 ft., 19 February, 1932 H. M. Pendlebury. Another male specimen in very bad condition from Kedah, Catchment Area near Jitra, 4 April, 1928, H. M. Pendlebury, probably belongs also here.

*Anapectamena pendleburyi* sp. n.

♂. Head and antennæ black; the undersurface of the two first joints and the basis of the third yellowish; labrum and tips of the mandibles brown. Thorax black; wings somewhat smoky with clearer bases; nervures and stigma black; coxæ blackish, trochanters partly infuscated, partly yellowish; femora infuscated with yellowish apex; tibiæ yellow with black tips; tarsi pale yellow, the three last joints infuscated. Abdomen black.

Head seen from above very short and broad, and nearly as broad as thorax, behind eyes narrowed, with distinctly sharpened hind margin, very finely punctate and besides on the front transversely striate, finely and shortly haired, shining. Hind orbits rather narrow. Vertex a little more than twice as broad as long, in the middle with a fine longitudinal furrow; postocellar furrow wanting, side furrows rather well developed. Ocelli just below the supraclypeal line; interocellar furrow very inconsiderable and ocellar basin not distinctly developed. POL: OOL about 3:4. Frontal area very flat and without distinct limits on the sides. Median fovea not very deep, transverse. Above the antennæ a distinct crest, the front thus somewhat broken. Antennæ nearly as long as head and thorax together, filiform and in the middle only very slightly thickened, rather finely and shortly haired; first joint only very slightly broader than the second and about as long as that joint; third joint somewhat curved, about  $1\frac{1}{2}$  times as long as the fourth; the last joints about three times as long as broad. Face below antennæ short, and rather flat. Clypeus nearly three times as broad as long, somewhat prominent not very convex and with slightly emarginate front margin; supraclypeal furrow rather distinct. Labrum short. Malar space linear.

Thorax moderately convex, finely and shortly haired, very finely and nearly invisibly punctate, very shining; scutellum

nearly quadrate with rectangular præscutellar furrow, rather flat. In the forewings the costa much dilated before stigma; cubitus on the basis with an angle; first transversocubitalis obliterated; discoidal nervure bent and meets the subcosta some-way before the origin of cubitus; first transverso-areal nervure reaches the discoidal cell a little behind its middle. Humeral cell in the hindwings rather longly appendiculate. Hind tibiæ about as long as the hind tarsi; hind metatarsus nearly as long as the following joints together; claws with a very long and slender inner subparallel tooth.

Abdomen rather longly oval, impunctate, sparsely and rather shortly haired, shining. Last ventral plate broadly rounded apically.

Female unknown.

Expanse: 10 mm.

Length: 4.5 mm.

One male (holotypus) from Federated Malay States: Perak, Larut Hills, 4,500 ft., 18 February, 1932, H. M. Pendlebury. Named in honour of the collector.

Very near *A. jacobsoni* Ensl., from Java and Sumatra and *A. horni* Forsius, from Formosa, but the antennæ are on the bases distinctly clearer and on the apical part not very much infuscated; the basis of the tarsi is yellow and only the two apical joints are infuscated. The head is above finely but distinctly punctate, the antennæ are somewhat longer than in *A. horni* Forsius, and the two first joints of antennæ are subequal in length.

**Anapeptamena albicornis** Forsius.

One female from Federated Malay States: Perak, Batang Padang, Jor Camp, 2,000 ft., 3 June, 1923, H. M. Pendlebury.

I have described this species as an *Anapeptamena* Kon., but the discoidal nervure is nearly parallel with the first recurrent nervure and thus in build nearly as in the species of *Aneugmenus* Hart. There are several Oriental genera of the earlier tribes *Hoplocampini* and *Selandriini* which are very closely allied, if not identical. The differences between these genera are at least very difficult to set out. I think that the genus *Nesoselandria* Roh. may be synonymous with *Anapeptamena* Kon. Particularly the genus *Selandria* Leach *sensu lat.* is a difficult one to separate from the several nearly allied genera (*Stromboceros* Kon. *Neostromboceros* Roh., etc.).

**Genus Neostromboceros** Rohwer

All the following species belong to *Stypoza* Enderl. Probably Rohwer has not observed the basal angle of the tarsal claws. I suppose that these two genera may be synonymous. This genus,

comprising the majority of species described as *Stromboceros* Kon. from the Oriental Region, is very insufficiently known and several species cannot be separated with certainty without referring to type specimens. My determinations are therefore provisional and I have hesitated to describe new species of some groups.

***Neostromboceros albicomus* Kon.**

One female from Malay Peninsula: Kedah, Gurun, November–December, 1916, H. C. Robinson and C. B. Kloss. Three females from Kedah, Catchment Area near Jitra, 7–10 April, 1928, H. M. Pendlebury. Six females from Malay Peninsula, West Coast, Langkawi Islands, 19 April–1 May, 1928, H. M. Pendlebury. One female from the same locality but taken 20th August, 1928, H. M. Pendlebury.

*N. coeruleomicans* Forsius, from Sumatra, is probably only a colour variety of this species with white clypeus and labrum and not well developed dark colour on the first and last tergite. Some of the Malaysian specimens have the apex of clypeus a little paler and others the last tergites more or less yellowish.

***Neostromboceros laevis* Kon.**

One male and one female from Sumatra: Kabandjahe, 4,300 ft., 31st December, 1929, H. T. Pagden. One male from Sumatra: Brastagi, 5,000 ft., 31st December, 1929, H. T. Pagden.

The legs of this species are, as in other specimens from Sumatra earlier determined by me as *N. laevis* Kon., very pale coloured (the femora only on the basis and the tibiae on the tips very inconsiderably infuscated); the wings are clear and the sheath in the middle very much dilated and posteriorly again acuminate.

***Neostromboceros luchti* Malaise (in litt.)**

One male from Malay Peninsula: Selangor, foothills of Gunong Hitam, December, 1909. Three males and one female from Selangor, Kuala Lumpur, 24 July, 1923, H. M. Pendlebury. One male from Perak, Batang Padang, Jor Camp, Tapah, 16–12 mile, 5 March, 1925, H. M. Pendlebury. One male and three females from Kedah, Catchment Area near Jitra, 5–9 April, 1928, H. M. Pendlebury. One male from Selangor, Gombak Valley, 16 mile, 23 March, 1928, H. T. Pagden. One male from the same locality but taken 22 July, 1928, H. T. Pagden. One female from Selangor, Kuala Lumpur, Ampang Forest Reserve, 28 October, 1928, H. M. Pendlebury.

I have lately received from Dr. Malaise some specimens of this species from Java and labelled *Ateloza luchti* n. sp. This is one of the blue species with a pale labrum and dark clypeus. The sheath is very much dilated towards the end.



**Neostromboceros sp. ? n.**

One female from British North Borneo: near Kinabalu, Kabayau, 10 May, 1929, H. M. Pendlebury.

A blue species, 10 millimeters in length. Head very much dilated behind eyes, wings yellowish infuscated, sheath only shortly exerted and on the basis rather broad but toward the apex strongly narrowed and nearly acuminate.

**Neostromboceros coxalis F. Sm.**

One male from Malay Peninsula, Kedah, Catchment Area near Jitra, 11 April, 1928, H. M. Pendlebury, and one female (without abdomen) from Peninsular Siam, Nakon Sri Tamarat, Khao Luang, 2,000 ft., 2 April, 1922, (H. M. Pendlebury), probably belong to this obscure species.

**Neostromboceros cyaneus End.**

One female from Malay Peninsula: Pahang, Batu Balai Estate 16 March, 1927, E. Seimund.

**Neostromboceros borneensis sp. n.**

♀. Head black with a slight bluish tinge; labrum and palpi brownish. Thorax black with bluish suffusion; episternum of mesopleurae and cenchri whitish. Wings very slightly yellowish tinged; nervures and stigma dark piceous, the basis of stigma however indistinctly paler and the middle part of subcosta, the greater part of medius, brachius and humerus pale brownish. Coxae, trochanters and legs black and only the tibiae posteriorly on the basis whitish. Abdomen black with purplish tinge.

Head rather finely and densely punctate, finely and rather shortly obscurely haired, shining; behind eyes rather narrowed; not margined posteriorly. Vertex a little broader than long, rather convex, with rather deep and outwardly convex side furrow. Ocelli in a rather low triangle, the posterior ones below the supraorbital line; interocellar furrow and ocellar basin not very deep; POL: OOL about as 1:2; below the anterior ocellus a narrow and short longitudinal crest. Frontal area distinct but without crests and almost flat and only above somewhat impressed. Eyes long oval, toward clypeus somewhat converging. Median fovea rather large. Antennal furrows distinct. Antennae a little longer than head and thorax together, in the middle somewhat thickened and towards the end acuminate; first joint somewhat longer and broader than the second which is about as long as broad; third joint distinctly longer than the fourth; the following joints very slightly serrate below and the last joint very narrow and about three times as broad as long, with blunt side corners, on the sides basally depressed and with somewhat incrassate straight front margin. Labrum moderately long. Malar space linear.

## NOTES ON A COLLECTION OF MALAYSIAN TENTHREDINOIDEA

Thorax very finely and rather sparsely punctate and rather finely and sparsely haired, very shining; mesopleurae with rather dense but very fine punctures, shining. Scutellum somewhat elevated and in front near the deep præscutellar furrow on the sides somewhat depressed. First transversocubitalis in the forewings obliterated and cubitus near the basis angled and the discoidal nervure somewhat curved and reaching the subcostal nervure a little before the origin of cubitus; the first areal nervure reaches the discoidal cell immediately distad of its middle. Humeral cell in the hindwings not appendiculated. Hind tibiæ about as long as the hind tarsi and the hind metatarsi about as long as the following joints together; claws cleft, the inner tooth robust and on the basis of the claws, a distinct, nearly rectangular angle.

Abdomen rather long, oval, impunctate and very finely and sparsely haired, very shining. Sheath seen from above on the basis rather narrow (probably not visible in all specimens), very much dilated toward the middle and then again narrowed and apically acuminate; seen from the side lancet-like.

Male unknown.

Length: 8 mm. Expanse: 17 mm.

One female (holotypus) from British North Borneo: Mt. Kinabalu, Lumu Lumu, 5,500 ft., 9 April, 1929, H. M. Pendlebury.

Distinguished by the yellowish tinge of the wings, the pale nervures on the basis of the front wings, the coloration of the legs, the sculpture of the head and the shape of the teeth.

### Genus *Malaisea* gen. n.

Body rather stout. Head a little narrower than thorax; eyes rather large, very slightly converging toward clypeus; hind ocelli in the supraorbital line; clypeus somewhat excised in front; antennæ stout, 9-jointed; first joint a little longer than the second, and the third joint about as long as the two following joints together; malar space distinct, but very short, linear, Discoidal nervure in the forewings parallel with the first recurrent nervure, and reaches subcosta in the origin of cubitus; two radial and four cubital cells; radial cells in both wings without distinct appendicular cell; stigma rather short, oval; recurrent nervures running to the second and third cubital cell; transverse humeral nervure very short and slightly oblique, and the humeral cell in the forewings consequently somewhat constricted. Hindwings with one closed middle cell; humeral cell appendiculate; areal nervure with about equal angles by brachius and medius. Hind coxæ not distinctly elongated; hind tibiæ longer than the hind tarsi; hind metatarsus about as long as the three following joints together; claws with a rather short but distinct erect inner tooth. Female not yet known.

Genotypus: *M. malayana* sp. n. from the Malay Peninsula.

This new genus belongs to *Selandriini*. Konow's key runs to *Lycota* Kon., but that genus has only a very small inner tooth on the tarsal claws, the malar space is distinctly longer, the second joint of the antennæ is much broader than long and the ocelli are situated above the supraorbital line. *Eriocampa* Hart. has two closed middle cells in the hind wings, *Netroceros* Kon. has cleft claws, in *Eusunoza* Ensl., *Beleses* Cam., etc., the hind coxæ are unusually long, in *Synaptoneura* Kon. the humeral cell is contracted and *Probleta* Kon. has a very obliquely crossing humeral nervure.

Named in honour of my friend René Malaise of Stockholm, a very interested student of Asiatic *Tenthredinoidea*.

***Malaisea malayana* sp. n.**

♂. Head and antennæ black. Thorax reddish and only mesosternum and parts of metasternum black. Wings rather brownish infuscated, the hindwings somewhat paler. Front coxæ reddish; front femora below reddish but above blackish infuscated; front trochanters and other parts of these legs black; posterior legs wholly black. Abdomen with a faint bluish tinge; the four first tergites in the middle more or less reddish-brown; hind margins of the other tergites in their middle pale.

Head somewhat narrower than thorax, behind eyes rather strongly narrowed, shining, above with some rather fine and remote punctures, below more densely and coarsely punctate and here less shining; the hairs of the head short and not very dense, black. Vertex convex, a little broader than long, with deep side furrows and distinct postocellar furrow and in the middle furnished with an indistinct longitudinal furrow. Eyes rather long oval with somewhat converging inner margins. Posterior orbits rather narrow, posteriorly not carinate. Ocelli in a rather low triangle; POL: OOL about as 2:3; interocellar furrow deep and ocellar basin distinct. Antennal furrows rather well developed. From the upper end of the eyes runs a furrow towards the frontal area. Frontal area small, but well limited by rather high sidecrests and is in the middle impressed; front crest in the middle excavated. Below the anterior ocellus a rather deep transverse groove. Antennæ about as long as thorax, from the sides somewhat compressed and in the middle somewhat broadened and toward the apex not very acuminate; first and second joint about equal in length and breadth. Between antennæ a longitudinal crest. Clypeus short and but slightly convex and with distinct supraclypeal furrow and emarginate front margin, about four times as broad as long in the middle. Labrum not very long and with very broadly rounded front margin. Malar space linear.

NOTES ON A COLLECTION OF MALAYSIAN TENTHREDINOIDEA

Thorax moderately convex, rather finely and sparsely punctate, finely, rather shortly and sparsely haired, shining. Medial lobes of mesonotum anteriorly more convex and with very sloping front faces. Scutellum nearly pentagonal, not very convex and more coarsely punctate. Third cubital cell in the fore wings much longer than the two foregoing cells together. Hind tibiae much longer than the hind tarsi and the hind metatarsus only slightly longer than the three following joints together.

Abdomen rather short oval, finely and very superficially punctate, finely and sparsely and shortly haired, distinctly shining. Last ventral plate rather large, in the middle indistinctly keeled and posteriorly nearly truncate.

Female unknown.

Length: 9 mm. Expanse: 18 mm.

One male (holotypus) from Malay Peninsula: Kedah, Catchment Area near Jitra, 6 April, 1928, H. M. Pendlebury.

Genus *Atlophorus* Burm.

*Atlophorus orbitalis* Kon.

Malay Peninsula. Four males from Pahang: Lubok Tamang, 3,500 ft., 11-12 June, 1923, H. M. Pendlebury. One male from Perak: Batang Padang, Jor Camp, 4 March, 1924, 1,800 ft., H. M. Pendlebury. One male from Pahang: Cameron Highlands, Sungai Boh, 27 May, 1931, 2,700 ft., H. T. Pagden. One female from Cameron Highlands, 4,600 ft., 29 May, 1931, H. T. Pagden.

*Atlophorus similis* Forsius.

Three males and three females from British North Borneo: Mt. Kinabalu, Tenompok Pass, 4,700 feet., 18 March, 1929, H. M. Pendlebury. One female from British North Borneo: Mt. Kinabalu, Lumu Lumu, 5,500 ft., 19 April, 1929, H. M. Pendlebury.

*Atlophorus jacobsoni* Ensl.

One male from Malay Peninsula, Selangor: Kanching, 28 December, 1930, H. M. Pendlebury.

The male of this species is so far as I know undescribed. It is somewhat paler coloured and more slenderly shaped than the female. Above the clypeus a triangular pale spot, the second joint of antennæ is at most part pale and only above apically infuscated; outer orbits pale. Mesopleuræ only below black. Basis of the fourth tergite blackish, the following tergites posteriorly narrowly margined with yellow; last ventral plate posteriorly broadly rounded.

**Atlophorus sumatranus** Forsius.

One female from Malay Peninsula: Selangor; Sungai Pomsom, Ulu Langat, 9 September, 1928, H. T. Pagden. One male (without abdomen) from Selangor: Kanching, 26 January, 1930, H. T. Pagden, probably belongs here.

**Atlophorus javanus** Ensl.

One female from Malay Peninsula: Pahang, Cameron Highlands, Sungai Boh, 27 May, 1931, H. T. Pagden. One male from Pahang: Lubok Tamang, 3,600 ft., 23 May, 1931, H. T. Pagden.

The colour of this species seems to be rather variable. The 2-5 joints of antennæ are more or less brownish, the dark spot on the front is smaller or larger and the pale markings on thorax and abdomen are also more or less extended.

The species *melanocoxa* Roh. and *leucocoxa* Roh. belong probably not to the genus *Atlophorus* Burm., but rather to *Emphytus* Klug.

**Genus Tritobrachia** Enderl.

**Tritobrachia tenuicornis** Enderl.

One female from Gunong Angsi, Negri Sembilan, 2,000-2,700 ft., April, 1918. One female labelled Thomson Road Reservoir, Singapore Id., 1 November, 1913, V. Knight.

**Genus Rhopographus** Konow.

**Rhopographus procinctus** Kon.

Malay Peninsula. One female from Selangor: Bukit Kutu, 3,500 ft., 18 April, 1921, H. M. Pendlebury. One female from Pahang; The Gap, 8 August, 1928, N. C. E. Miller. One female from the same locality, 2,700 ft., 3 January, 1930, H. M. Pendlebury. One male from Selangor; Bukit Kutu, 3,500 ft., 1 February, 1930, H. T. Pagden. Two females from Pahang: Cameron Highlands, Kuala Boh, 3,000-4,500 ft., 22-27 May, 1931, H. M. Pendlebury. One female from Pahang; Cameron Highlands, Tanah Rata to Padang, 4,800 ft., 29 May, 1931, H. M. Pendlebury.

I have described the female of this species as *Jacobsoniella brachycera*, being partly misled by Konow's description, and but recently though my revision of some Oriental genera of the sawflies I have observed my error. The humeral nervure is nearly transverse and the third joint of antennæ distinctly longer than the fourth in both sexes. Konow says particularly (in *Genera Insectorum* vol. 29, p. 108, 1905) "so lang oder etwas kurzer als das vierte", but this is probably a *lapsus calami*.

Genus *Allantopsis* Roh.

*Allantopsis solocicornis* Enderl.

One female from North Borneo: Bettotan, near Sandakan, 4 August, 1927, H. M. Pendlebury. One female from Sarawak: Lundu, April, 1913. One male from Peninsular Siam, Nakon Sri Tamarat, Khao Ram, 750-1,200 ft., 23 February, 1922. One male from Malay Peninsula, Selangor: Batu Caves, ex. coll. Agr. Dept., 20 February, 1907.

Genus *Emphytus* Klug.

*Emphytus borneensis* sp. n.

♀. Head black; side corners of clypeus and labrum dirty pale-brownish; first joint of antennæ and the basis of the second yellowish; thorax black; side corners of pronotum, tegulæ, parapteron and upper part of mesopleuræ, side corners of the middle lobe of mesonotum, scutellum, metathorax partly, and cenchri, pale brownish-yellow; tips of coxæ, trochanters almost entirely, apices of femora, basis of tibiæ (the front nearly wholly) and basis of front metatarsi dirty yellowish. Wings brownish infuscated, the basis somewhat clearer; nervures and stigma piceous; basis of costa and subcosta somewhat paler. Abdomen black but brownish-yellow above on the first five segments, the sides of the 4-5 tergites laterally somewhat infuscated.

Head behind the eyes strongly narrowed, above without distinct punctures, downwards very finely punctate and very finely hirsute, shining. Orbits narrow. Vertex somewhat convex, about as broad as long, with rather deep curved side furrows which do not reach the occiput, and distinct postocellar furrow. Eyes rather short oval with practically parallel inner margins. Ocelli in a rather high triangle, the posterior ones below the supraorbital line; POL:OOL about as 2:3. Interocellar furrow not very distinct; ocellar basin deep; below the anterior ocellus a triangular groove. Frontal area distinct and somewhat elevated, but without distinct side crests, in the middle rather deeply impressed in front. Antennal furrows rather deep. Interantennal space elevated. Frontal fovea rather deep. Antennæ longer than head and thorax together, in the middle somewhat thickened and from the sides slightly compressed, toward the apex acuminate; first joint about as long as the second, but distinctly broader and about  $1\frac{1}{2}$  times as long as broad; second joint about twice as long as broad, third joint distinctly longer than fourth; the penultimate joint about twice as long as broad and the last joint about four times as long as broad basally. Clypeus narrowed toward the front margin, about twice as broad as long, in the middle roundly and very deeply excised and with rather acuminate side corners. Supraclypeal

furrow distinct. Labrum broadly rounded in front. Malar space narrow but distinct.

Thorax very finely and rather densely punctate, finely and sparsely haired, shining. Scutellum flat; front corner acute, hind margin straight. Radial cells in the forewings without appendicular cell; first transversocubitalis wholly wanting and the first cubital cell distinctly longer than the second; stigma short oval; transversoradial nervure reaches the middle of the second cubital cell; discoidal nervure parallel with the first recurrent nervure and reaches the subcosta immediately before the origin of cubitus; the areal nervure reaches the discoidal cell between the first and second third; humeral cell with a not very oblique cross nervure. Radial cell in the hindwings without appendicular cell; no closed discoidal cell; humeral cell appendiculate; areal nervure somewhat oblique (about as in *Empria*). Coxæ rather short. Hind tibiæ about as long as the hind tarsi, and hind metatarsus somewhat longer than the following joints together. Claws with a rather large subapical tooth, which is nearly as long as and parallel with the apical tooth.

Abdomen very finely sculptured, finely and shortly haired, shining. Sheath viewed from above rather long and narrow, viewed from the side lancet-like.

Male unknown.

Length: 7 mm. Expanse: 15 mm.

One female (holotypus) from North Borneo: Bettotan, near Sandakan, 20 July, 1927, C. B. Kloss and H. M. Pendlebury.

This new species corresponds not wholly with the diagnosis of the genus *Emphytus* Klug, the second joints of antennæ being unusually long, the side corners of clypeus very much acuminate (as in *Tritobrachia* Enderl.), but it is in many other respects most allied to this genus. The colour is very peculiar, distinguishing this from all hitherto known species.

***Emphytus insularis* sp. n.**

♂. Very closely allied to, if not the male of the foregoing species, but so very differently coloured that I hardly dare risk to describe it as belonging to *E. borneensis* mihi. The following description contains the principal differences between that species and the present one.

Head and antennæ black; only the angles of clypeus and the outsides of the first joints of antennæ yellowish. Thorax black; tegulæ, parapteron of mesopleuræ, cenchri and transverse spots by the scutellum dirty yellowish. Wings rather yellowish hyaline, their apical half not distinctly infuscated. Humerus and axillus of the forewings and all nervures of the hindwings pale brownish. Abdomen black.

The antennæ are only very inconsiderably dilated in the middle; the penultimate joint nearly three times as long as broad. Humeral cell of the hindwings very shortly appendiculate. Hind metatarsus slightly shorter than the following joints together. Last ventral plate rather flat, posteriorly rounded.

Female unknown.

Length: 6 mm. Expanse: 12 mm.

One male (holotypus) from North Borneo: Bettotan, near Sandakan, 21 August, 1927, C. B. Kloss and H. M. Pendlebury.

Genus *Xenapates* Kirby.

*Xenapates incertus* Cam.

One male from Peninsular Siam: Nakon Sri Tamarat, Khao Luang, 2,000 ft., 20 March, 1922, H. M. Pendlebury, labelled *Xenapates incerta* Cam.=*ruficollis* Cam. One male from Malay Peninsula, Kedah, Catchment Area, near Jitra, 10 April, 1928, H. M. Pendlebury.

Tenthredinini

Genus *Macrophya* Dahlb.

*Macrophya pendleburyi* sp. n.

♀. Head and antennæ black; the two first joints of antennæ and the basis of the third above pale yellowish; palpi brownish, labrum whitish and tips of mandibles brown. Thorax black; hind corners of pronotum, tegulæ at most part, mesopleuræ and mesosternum, lateral margins of lateral lobes of mesonotum, sides of scutellum and the most part of metathorax reddish-brown. Wings basally rather hyaline, toward the apex more brownish dusky and especially infuscated below stigma; nervures and stigma dark piceous, the upper basis of costa yellowish. Coxæ black with pale yellowish tips. Trochanters pale yellowish. Legs yellowish; the anterior femora below infuscated, the hind with the apical half blackish; tibiæ yellowish, the hind with distinct black apex; tarsi infuscated and only metatarsus above somewhat paler. Abdomen black; the two first tergites dorsally wholly ochraceous (in the living specimen probably more reddish), the four following tergites in the middle with ochraceous spots which get broader toward the caudal margins and gradually become smaller toward the apex of the abdomen.

Head about as broad as thorax, behind the eyes very narrowed, posteriorly not carinate, finely and rather shortly haired, on the greater part very finely punctate and shining, but near the hind margin of vertex and posterior orbits with some large punctures, on the ocellar and frontal areas with very dense and large punctures and here opaque; and the face below antennæ



rather densely punctate and not very shining. Posterior orbits not very broad. Vertex scarcely longer than broad, not very convex; the lateral furrows convex, and vertex toward ocelli rather narrowed, and in the middle with a fine middle crest; postocellar furrow wanting. Eyes large and their inner margins only very slightly converging towards the clypeus. Ocelli in a rather high triangle, much below the supraorbital line; POL: OOL about as 1:2; interocellar furrow wanting and ocellar basin only indistinctly developed. Frontal area not limited and frontal fovea very insignificant and superficial. Antennal furrows indistinct. Supra-antennal grooves elongate and shining. Antennæ (accidentally?) 10-jointed, barely longer than thorax and inserted low down near clypeus, in the middle somewhat thickened; first joint a little broader than the second and about  $1\frac{1}{2}$  times as long as the second which is a little longer than broad apically; third joint nearly as long as the three following joints together and somewhat dilated towards the end; following joints only a little longer than broad apically and distinctly serrated below (in the male probably with longer denticles); last joint about  $2\frac{1}{2}$  times as long as broad basally and on the apex obliquely incised but not serrate. Interantennal space only slightly convex. Supraclypeal furrow distinct. Clypeus about three times as broad as long, with obliquely incised side corners and very slightly emarginate front margin and besides impressed in front. Labrum rather small and narrowly rounded in front. Maxillar palpi long and slender. Malar space linear. Mandibles three-toothed.

Thorax finely punctate and finely and sparsely haired, shining, and only here and there, especially on scutellum, with some larger punctures. Scutellum rather flat. Epimera of metapleuræ without large appendix. Stigma long oval and rather acuminate; transversoradialis begins from apex of the stigma and reaches the third cubital cell nearly in the middle; first transversocubitalis distinct; third cubital cell nearly as long as the two preceding together, somewhat dilated laterally and with somewhat acuminate hind lateral corner; first areal nervure reaches the discoidal cell in its first third; humeral cell very shortly constricted (as in *Beldonea* Cam. which now commonly is regarded as inseparable from *Macrophya* Dahlb.) and has on the left wing besides a nearly straight cross nervure a little outwards from the constriction, but this is no doubt an occasional abnormality; areal nervure showing by brachius a blunt, and by medius a more acute angle.

Abdomen rather short oval, not macroscopically punctate or sculptured and very finely and sparsely haired, very shining; median segment rather short and in the middle divided; blotch rather small. Sheath seen from above on the basis rather broad

and toward the apex gradually narrowed and at the end acuminate and rather longly haired; seen from side rather short and apically broadly rounded.

Male unknown.

Length: 8 mm. Expanse: 18 mm.

One female (holotypus) from Malay Peninsula, Kedah: Catchment Area near Jitra, 7 April, 1928, H. M. Pendlebury.

By the colour and the shape of the joints of antennæ easily separated from all hitherto described species. Named in honour of the collector.

#### Genus *Allantus* Jur.

*Allantus primoris* Kon. var. *indosinica* var. n.

♀. Two first joints of antennæ pale yellowish and only the second apically above slightly infuscated. Supra-antennal crests of the same colour, and prothorax has the sides of front below and the hind corners pale yellow. The mesopleuræ are obliquely striped with yellow behind the mesopleural carina, and the very highly elevated scutellum is of the same colour.

Male unknown.

Length: 15 mm. Expanse: 34 mm.

One female (holotypus) from Peninsular Siam; Nakon Sri Tamarat, Khao Ram, 750 ft., 2 March, 1922, H. M. Pendlebury. One female (paratypus) from Selangor, Ginting Bidai, 2,000 ft., C. B. Kloss.

The specimen from Siam bears a label with the note "*Allantus* sp. ? n., near *indica* Kirby=*dudgeoni* Cam." These specimens are however not, as far as I can find, particularly nearly allied to *A. indicus* Kby., but agree, with exception of some colour differences, very well with *A. primoris* Kon. This species, originally described from Sikkim, India, is probably a widely-spread species and equally variable as is the case with some Palearctic species of the group of *A. vespa* L., which vary considerably in regard to the colour of antennæ, head, thorax and abdomen. I think therefore that this new form may be a variety of *A. primoris* Kon. The above description contains only the differences between the typical form and the new variety.

#### Genus *Tenthredo* L.

*Tenthredo lepcha* Cam.

One female from India, labelled *Tenthredo xanthoptera* Cam? *Tenthredo* sp. ? n.

One male from Kuala Lumpur, ex Coll. Agr. Department.

Unknown to me. Probably represents a new species, but I hesitate to describe a new species of this genus upon a single male specimen.

## A New Flying-Squirrel from Borneo

By F. N. CHASEN

**Petaurista punctatus banksi** subsp. nov.

Like *Petaurista p. punctatus* (Gray) of Malacca but with the top of the head, neck and back glossy black flecked with white; the tail black and the chestnut parts of the pelage deeper in colour.

*Colour*.—General colour above from nose to rump, black with large white flecks. Patagium deep chestnut above, tawny-rufous below. Under surface, except on the limbs, paler, ochraceous-rufous. Upper part of the limbs like the patagium; digits and edges of the feet, black. Chestnut of the patagium continued as a broad band across the croup on which an indistinct blackish area joins the black saddle to the entirely black tail. Sides of the head, tawny sprinkled with black; a dark ring round the eyes and a small black spot on the chin. Vibrissæ black. Ears missing. Base of the fur on the upper parts, slaty; on the black areas, subterminally rufous, but this cannot be seen unless the long fur is disturbed.

*Type*.—The skin of a female, unfortunately without skull, collected at Lumu Lumu, Mount Kinabalu, north Borneo, 5,500 feet, by a native collector of the Botanic Gardens, Singapore, in May 1933 and presented to the Raffles Museum by Mr. R. E. Holttum.

*Specimens examined*.—The type and a flat-skin seen but not obtained by me in a native house in a Dusun village in the Kinabalu foot-hills.

*Measurements*.—Taken dry in the skin which seems to be of reasonable proportions—head and body, 350 mm.; tail, 360 mm.; hind-foot, 60 (minimum) mm.

*Remarks*.—With its shining black, white-spotted saddle this flying-squirrel cannot be confused with any other form. This rare species has not hitherto been recorded from Borneo and only one specimen is known from Sumatra.

Three races are now known from Malaysia. The typical form from the Malay States is chestnut in colour, flecked with white on the upper parts. *P. punctatus sumatranus* Kloss,<sup>1</sup> is very similar but has the white flecks reduced. The Bornean form described above is named after Mr. E. Banks, the Curator of the Sarawak Museum.

1. Journ. F. M. S. Mus., X, 1921, p. 230 (Padang Highlands, west Sumatra).

## Notes on Bornean Mammals

by F. N. CHASEN

### *Systematic.*—

*Tupaia tana nitida* subsp. nov.

*Sciurus prevosti banksi* subsp. nov.

When Mr. Boden Kloss and I wrote our paper on the mammals we collected in British North Borneo in 1927<sup>1</sup> lack of comparative material forced us to leave open a number of questions of systematic interest. It is now possible to deal with some of these owing to the generous action of Mr. E. Banks of Kuching who has kindly sent to Singapore all the relevant material belonging to the Sarawak Museum.

*Rattus concolor ehippium* (Jentink).

No colour distinction can be maintained between animals from various localities throughout Sarawak and those listed from the mainland and islands of north Borneo.

*Sciurus prevosti banksi* subsp. nov.

*Characters.*—Nearest to *S. p. caroli*<sup>2</sup> Bonhote, of Sarawak but much darker dorsally, the back almost black: black lateral stripe well developed. Feet blackish, not red.

*Colour.*—Upper parts, including the feet, black grizzled with whitish especially on the top of the head and shoulders which are therefore lighter than the back and feet on which the grizzling is very fine. White lateral stripe wide, spreading on the thighs as a broad patch: black lateral stripe, broad and conspicuous. Cheeks, grey: face, pale chestnut. Under parts very deep chestnut. Tail broadly annulate whitish and black, the general effect whitish grey.

*Type.*—Adult male, skin with skull inside, collected by C. Hose: labelled "Baram 1891". Raffles Museum No. 3935.

*Remarks.*—The type locality of *S. p. caroli* is the "Murudi River, Baram district": Murudi is on the Baram River about thirty miles, in a direct line, from the sea. Specimens in the Raffles Museum are from Balingian (about half-way along the Sarawak coast) and "Baram". Other examples examined are from Bakong (below Murudi) on the Baram River. All have red feet and the series is fairly constant although the Baram skins tend to be darker on the lower back and to have the black lateral

1. On a Collection of Mammals from the Lowlands and Islands of North Borneo", Bull. Raffles Mus., 6, 1931, pp. 1-82.

2. *Sciurus Caroli* Bonhote, Ann. Mag. Nat. Hist. (7) VII, 1901, p. 173.

stripe more obvious than those from Balingian. Mr. Banks<sup>1</sup> considers that this red-footed race is found "fairly pure in the country between the coast and the Rejang River, from as far west as Oya up to Miri and even Baram". In the latter district, however, *S. p. caroli* is very unstable and intergrades with *S. p. griseicauda*. Belaga on the upper Rejang River in Central Sarawak and Mt. Dulit also produce intermediates as well as examples fairly representing both races.

In his paper Mr. Banks has discussed the range of the *prevosti* forms occurring in the Baram district in detail: the main point of immediate interest is that he segregates a number of animals in the neighbourhood of the lower reaches of the Baram river as a definite "phase". This phase, he believes, occupies the swampy, lower Baram area from the sea up to Murudi Station.

As this "phase" is well-marked, fairly constant, dominant in a certain area, and has a definable geographic distribution there seems no reason why it should not be differentiated as a subspecies or geographical race. Its range has yet to be worked out in detail, but approximately it is the white space on Mr. Banks' map between the country in which *griseicauda* is dominant and the sea: typical examples of it are found as far north as Limbang where also, as at Trusan, occur animals intermediate between it and *griseicauda*. Somewhere or other, it seems certain that *banksi* must embrace the range of *S. p. suffusus*<sup>2</sup> but this latter is a most mysterious animal and still only known from the skins on which the original description was based: it is a very distinct form supposed to have come from the Tutong River in Brunei.

I have associated this subspecies with the name of Mr. E. Banks, Curator of the Sarawak Museum, who has been especially interested in the *prevosti* group of squirrels for several years.

### ***Tupaia dorsalis* Schlegel.**

Specimens sent from localities between Mt. Poi in the extreme west of Sarawak and Mt. Murud in the north-east indicate that variation in the colour of the posterior upper parts is dependent on the age of the pelage, which when fresh is rather yellower and less reddish than when in "bleached" or worn condition. Only one race can be recognised for Sarawak and British North Borneo.

1. "The Forms of Prevost's Squirrel found in Sarawak", Proc. Zool. Soc., 1931, p. 1339.

2. *Sciurus baluensis suffusus* Bonhote, Ann. Mag. Nat. Hist. (7) VII, 1901, p. 175.

***Tupaia glis longipes* (Thos.).**

The series from the Sarawak Museum is most instructive, and together with the material from north Borneo can be divided readily into two groups:—

- (1) From localities in the extreme west of Sarawak.—Pankalan Ampat (June); Lundu (June); Kuching (March, Sept., Oct.); and Samarahan (Oct.).
- (2) From localities in northern Sarawak and British North Borneo.—“Baram” (Feb.); Limbang (Jan.); Lio Matu and above this place in the Ulu Baram (April, Oct.); Rayoh in the gorge of the Padas River which runs into Brunei Bay (July); and various localities near Sandakan (July, August).

Without exception, animals of the second group can be separated from those of the first by the greyer, much less brightly coloured under side of the tail. As a series, they are also more olive and less reddish on the upper surface especially anteriorly, and the shoulder stripe is less deeply coloured. In a few cases these last given characters will not separate animals of the two groups and they may depend on the age of the pelage. It is just possible that all the differences noted above are due to the same cause but the dates on the labels do not support the view that there is any seasonable change of pelage. Animals with the greyest and freshest pelage are from Limbang (Jan.) and Lio Matu (April) while the reddest and most worn skins are from Samarahan in October but the series cannot be arranged evenly between these two extremes. For the present therefore, it seems advisable to recognise two races of this shrew in Sarawak separable on the colour of the under side of the tail and perhaps on the general tone of the pelage as well.

The duller, northern race is *T. g. longipes* Thos., which was collected by Low in “N. W. Borneo” and almost certainly came from the mainland opposite Labuan. On description the brighter, western race seems to be *T. g. salatana* Lyon, or very near it, and pending comparison of topotypes from south-east Borneo with specimens from west Sarawak *salatana* must be regarded as occupying all Borneo except the northern part: on the north western coast it extends northwards to at least Long. 110–111° E.

A specimen from Lawas, which on locality should be *longipes*, has the bright tail of *salatana* but it is, I think, immature.

Lyon<sup>1</sup> includes animals collected by Doria and Beccari in “Sarawak” under “*T. l. longipes*” but the specimens are preserved

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1. Proc. U. S. Nat. Mus. 45, 1913, p. 79.

in alcohol, skeletons, or mounted, and therefore useless for colour examination: they probably belong to the form regarded as *salatana* above.

Fresh material is needed before the distribution of the races of this species in Borneo can be worked out in any detail. From Sarawak, animals in fresh pelage from the neighbourhood of Kuching, and specimens from anywhere between that place and the Baram River are especially required.

**Tupaia tana (Raffles).**

A beautiful series of this shrew from the neighbourhood of Kuching and other localities in the south-west of Sarawak confirms the suggestion made by Mr. Kloss and myself (based on the material in the Raffles Museum and the British Museum of Natural History) that *T. t. utara* Lyon, described from Mt. Dulit is not found throughout Sarawak but that the south-west or west of the State is occupied by an undescribed, very bright race.

**Tupaia tana nitida subsp. nov.**

*Diagnosis.*—Like *T. tana utara* of Mt. Dulit but brighter in colour. Forelimbs and sides of the body, particularly anteriorly, less brownish and more deeply red: nape darker and the pale areas on each side of the dorsal stripe darker; the dorsal stripe is therefore less conspicuous than in typical *utara*. The black patch on the lower back usually more conspicuous. Under side of the body more deeply coloured and less yellow. Tail less blackened.

*Type.*—Adult male, skin and skull (back of the skull cut away after the manner of bird-collectors) collected on Mt. Poi (500 ft.), west Sarawak, by Dr. E. Mjöberg on 17th Nov. 1923. Sarawak Museum No. A26. 327.

*Remarks.*—Examples of this race have been examined from Mt. Poi; Lundu; Samarahan; and Kuching, all in western Sarawak: all are separable from *utara* of Mt. Dulit; "Baram"; and Miri, on the characters given above.

Immature examples of *nitida* are comparatively dull and therefore rather like adults of *utara* but the under side of the tail is brighter. Examples from the neighbourhood of Kuching are not quite so distinct from *utara* as are those from the more remote Mt. Poi. On the upper parts some of the Kuching skins are very near to *utara* but the tail is always less blackened above and brighter below.

A specimen from Ulu Mukah in central Sarawak is *utara*.







**I. A. R.**

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